THE COPPER HANDBOOK

A MANUAL OF THE COPPER INDUSTRY
OF THE WORLD

VOL. VII

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HORACE J. STEVENS
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Following the text of the book is an advertising section, carrying the announcements and cards of manufacturers, dealers in mining supplies, copper producers, engineers, metallurgists, chemists, trade journals, etc.

PREFACE.

It is not pleasant to introduce a new volume to its readers with an apology, especially when the preceding annual number was introduced similarly, yet such needs must be the case. For the manifest shortcomings of Volume VII of the Copper Handbook, compassion is asked from its readers. On January 15th, 1907, a fire in the premises of the printers and binders of the book destroyed 1,650 copies of Volume VI, the edition then current, also 185 copies of Volume I, on hand for rebinding. The electrotype plates of the edition were buried under several hundred tons of brick and mortar, for some months, and upon being exhumed, were found considerably damaged, so that resetting a large part of the volume was obligatory. Four days after the fire it became necessary for the author and his daughter to take Pasteur treatment, on account of the bite of a rabid cat. Some weeks later a virulent case of blood-poison developed, while the author was on his way south, and, after suffering with the disease through the states of Indiana, Kentucky, Tennessee, Alabama, Mississippi and Louisiana, medical attendance was secured in New Orleans, followed by two severe surgical operations, the second without an anæsthetic, with some months of total disability.

As a result of this series of troubles, five months time was lost, and it was impossible to revise the long chapter of detailed mine descriptions, containing 4,626 titles, in time for the issue of a new edition during 1907. As the Copper Handbook is an annual, born with the Twentieth Century, it was felt that the missing of a year's issue would be a serious mistake, hence it was decided, as the only alternative, that the 1907 edition should appear with the preliminary and statistical chapters fully rewritten, but with the mine descriptions unchanged from the preceding year. The fourteen preliminary chapters in Volume VI have appeared unchanged in the four preceding annual editions, from sheer lack of time to revise them, much as such revision was needed, an average of fourteen months time having elapsed between each of the annual editions since the first. These preliminary chapters have been revised carefully and greatly amplified, making twenty-three chapters in the present edition, this work requiring six months, and the statistical chapter has been revised, as in all previous editions. The apologies of the author are extended to all readers, but the circumstances have been such that the course taken seemed the only one available. The next annual edition, which will contain upwards of six thousand titles, will have all mine descriptions rewritten, except such properties as are dead and buried, in which case there seems no good reason for disturbing the epitaphs.

As in previous editions, the author wishes expressly to disclaim all pretensions to infallibility, and to request corrections and criticisms from all sources. This invitation has been accepted heretofore in numerous in-

stances, and much benefit has resulted from the suggestions, criticisms and corrections so given. It is manifest that a work dealing with an industry of great size, distributed over all parts of the world, is especially liable to error. That the work contains so large a proportion of truth is due largely to mining men and investors who have furnished information and corrections.

The hearty thanks of the author are due, and are tendered hereby, to the men in actual charge of copper mining, milling and smelting operations, in all parts of the world, who have manifested the liveliest interest and good will. Direct returns are now secured from a majority of the producing copper mines of the globe, and with the exception of unworthy corporations, formed for stock-jobbing purposes, very few mining companies refuse information. It has taken time to convince the mine managements that they will be dealt with fairly, but the confidence of the producers having been secured, readers reap the benefit.

The issue of this work was begun with certain fixed views and plans. In the course of time it has become possible to approximate some of the plans made at the beginning, and the original outline of the work has been changed in no essential feature, though modified in minor details from time to time. The wisdom of the original plan is being verified by the outcome, and it is with considerable pride that the author is able to state that the circulation of Volume VI exceeded five thousand copies, this being the largest circulation enjoyed by any mining annual published in any language.

In the final section of the book will be found some sixty pages of advertising. The advertising section of the work is censored, and no business is accepted unless it is deemed to come from a reliable person, firm or company. For several years past no copper mining company advertising has been accepted from any but producing mines, and no advertising is desired from any corporation having shares for sale. This rule operates, at times, to bar out worthy companies, but it is obvious that all companies seeking funds from the public should be dealt with solely upon their merits, in the text of the work itself, and it is equally obvious that money received for advertising might, unwittingly, influence an opinion more favorable than was warranted by a dispassionate consideration of the facts in a given case.

HORACE J. STEVENS.

Houghton, Michigan, U. S. A., Dec. 20, 1907.

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CHAPTER I.

THE HISTORY OF COPPER.

The mists of antiquity shroud the discovery of copper, but the metal and its alloy, bronze, were known at a period so remote as to antedate the beginnings of history. Possibly gold, which occurs native, was discovered before copper, but the uses of gold in prehistoric times seem to have been purely ornamental, while those of copper, and its alloy, bronze, were utilitarian as well as ornamental, from their discovery.

The Neolithic, or polished stone age, was succeeded by the age of bronze, but the process of substituting weapons and implements of bronze for those of polished stone was not instantaneous, and doubtless was spread over hundreds of years, as polished stone and bronze instruments, obviously of about the same age, have been found in juxtaposition, at many points, and it should be borne in mind that while the comparatively civilized peoples of Asia Minor and the Nile valley were far advanced in the bronze age, the Greeks doubtless were in the Neolithic period, while the barbarians to the north had not advanced beyond the Paleolithic age. Similarly, the natives of the two Americas were in the bronze and stone ages, when discovered by Columbus, in the Fifteenth Century, at a period when the civilized peoples of Europe had left the bronze age two thousand years behind.

Copper is one of the six metals mentioned in the Old Testament, and the bible names Tubal Cain as a cunning artificer in brass and iron. A legendary account of the discovery of iron on Mount Ida has been handed down, but it is certain that copper was known to the ancients for a long time, probably some thousands of years, before the discovery and utilization of iron, and it is known that copper mines were worked on Mount Ida, in Asia Minor, centuries before the alleged discovery of iron.

According to the latest historical investigations, copper was known long before the time of Menes, the founder of the First Dynasty, who was the first king of Upper and Lower Egypt, and who reigned at a period possibly as early as 5500 B. C. Copper was known, at least as a rarity, by one of the aboriginal races of Egypt, probably as early as 7000 B. C. and possibly at a date considerably more remote. At a much later period, yet antecedent to the First Dynasty, the use of copper became more

widely disseminated, and the metal was in quite general use in Egypt before the time of Menes. It is believed that the Egyptians used unalloyed copper for centuries before discovering the use of tin, the alloy of copper and tin producing bronze that is much harder than pure copper, consequently much better suited for weapons and implements of all sorts. The ancient Egyptians are believed to have used arsenic for hardening the copper when used alone.

Bronze was in very early use in Egypt, for the making of weapons and tools, and the use of bronze is mentioned in inscriptions antedating the great pyramids. Rawlinson says "A metallurgy of no small merit must have formed and originated the implements whereby materials, such as those used by the Egyptian scupltors, were worked with ease and freedom." Some of the blue and green pigments used by the earliest Egyptian painters contained copper.

King Sneferu, the first Pharaoh of the Fourth Dynasty, ascended the Egyptian throne at a date variously estimated from 2000 B. C. to 5000 B. C., succeeding the king who carved the great sphinx, and being in turn the immediate predecessor of Cheops, builder of the great pyramid at Gizeh. King Sneferu, according to the inscriptions of his reign, conquered the Sinaï Peninsula for its stores of mineral, hence the inference that its copper mines must have been opened at an even earlier date. The copper mines of Mount Sinaï, which are the oldest now known to man, are said to have been worked as recently as 1300 B. C. Ancient workings are still visible, with slags from the furnaces and occasional remains of tools. The oldest piece of bronze, of anything like an established date, is a knob from the scepter of Pepi I, a Pharaoh of the Sixth Dynasty, who flourished circa 3000 B. C. This remnant of the regal might of an early day now reposes in the British museum. The Posno collection, in the Louvre, at Paris, shows two small statues, believed by Perrot to date from the close of the Old Empire, or the beginning of the Middle Empire, circa 2300 B. C. These are light, hollow and cast in single pieces, showing workmanship of a high order. A hollow cast statue of Rameses II, of excellent workmanship, dates from 1300 B. C. As early as the New Empire, more than 2000 B. C., copper seems to have been the monetary basis of Egypt, as accounts were recorded in uten of copper, the uten being a spiral of metal, of about 91 grams weight. In the time of the New Empire, bronze was in use for armor and weapons, artisans' tools, occasional farm implements, household utensils, nails, locks, butts, hardware for chariots and boats, and for jewelry and general decorative purposes. In the old hieroglyphs, several varieties of bronze are referred to, according to their composition. The most common variety of bronze in use in ancient Egypt, as determined by modern assays, contained, respectively, 85 per cent copper and 15 per cent tin, and 88 per cent copper and 12 per cent tin, while bronze used for weapons and cutting tools contained 94 per cent copper, 5.9 per cent tin and 0.1 per cent iron, the iron probably having been included as an impurity, and not through design.

M. de Sarazé judges that copper was produced in Babylonia about 4000 B. C. Gudea, patesi or high priest of Lagash, who became a dependent king under Dungi II of Babylon, who reigned approximately 2000 B. C., at Ur—"Ur of the Chaldees"—collected, as material for temples and statues,

copper from northern Arabia, and the metal and its alloy, bronze, were in quite general use throughout Babylonia at least as early as 2000 B. C.

Apparently copper was known to the Greeks from the earliest historical times. The ancient Greek historians credited the discovery of copper to Cadmus, who also is said to have invented the alphabet, both of which credits are open to serious doubt, as Cadmus really adapted the Phœnician alphabet to Greek use and doubtless brought the first knowledge of copper smelting to the Greeks from the same source. Apparently copper was first found by the Greeks near Chalkos, on the Island of Eubœa, hence took the name of chalcos, and was so termed by Homer, Hesiod and other early Greek authors. Pliny states that the method of reducing copper from its ores was discovered on the Island of Cyprus, whence the metal was termed by the Romans, first aes cyprium, and later, cuprum. This discovery unquestionably was merely an adaptation of the methods known to the Egyptians several thousand years earlier. The name of the metal in most of the modern European languages, as the English copper, Swedish koppar, Norwegian kobber, German kupfer, Spanish and Portuguese cobre, and French cuivre, are corruptions of the Latin cuprum. In the ancient mythologies, copper was consecrated to Hathor by the Egyptians, to Aphrodite by the Greeks and to her counterpart, Venus, by the Romans.

It is probable that the first copper mines of Cyprus were opened by the Phœnicians and that knowledge of the metallurgy of the metal was derived from them by the Greeks. The Phœnicians also brought copper from Asia Minor, and later from Iberia, beyond the Pillars of Hercules, and some of the ancient Carthaginian mines, in the Provinces of Huelva in Spain, and Alemtejo in Portugal, were reopened during the latter half of the Nineteenth Century, and remain large producers. It is certain that the Phœnicians brought tin, and possibly copper also, from Cornwall, at a period as remote, in all likelihood, as 500 to 700 B. C., which would indicate that the native Britons were possessed of a rudimentary metallurgy of considerable importance, at a period long antecedent to the conquest of Caesar. The hegemony of the ancient Phœnician world was wrested from the cities of Tyre and Sidon by Carthage, an early Phœnician colony which became far greater than its parent, and Carthage, in turn, lost the supremacy of the Mediterranean to the Romans.

The knowledge of copper possessed by the Romans doubtless was inherited from the Greeks, all of the historical evidences pointing to this conclusion, but it is certain that copper mines in Tuscany were worked by the Etruscans previous to the foundation of Rome. The copper mines of Piedmont, Liguria and Tuscany were worked extensively in Roman times, but the Iberian mines, wrested from the Carthaginians, formed the chief source of the copper supply of the Roman Empire. Spain has been furnishing copper to the world for nearly or quite three thousand years, and remains one of the principal sources of the world's supply. The Rio Tinto mine has been worked, off and on, for about three milleniums, yet remains one of the greatest copper producers of the globe. Prof. Vogt estimates that not less than twenty to thirty millions of metric tons of ore were mined during the eras of Phœnician, Carthaginian and Roman domination, from this mine alone.

During the dark period of the middle ages, mining, while not a lost

art, certainly was not followed as systematically and successfully as during the more prosperous and enlightened era of the Roman Empire. The world's supply of gold and silver decreased from century to century, owing to the losses from attrition and misplacement not being made good by new production. Iron, being subject to rust, was mined and smelted as required, though the production was surprisingly small, and it is probable that the United States Steel Corporation now turns out, in every working day, more iron than was produced in all Europe in a full year, during the period of greatest darkness of the mediæval era. The supply of copper during the middle ages must have been very small, but statistics are so fragmentary that they scarce afford basis for estimates.

The production of copper from Iberian mines was spasmodic, but more or less of the metal was produced in every century, though the industry suffered a severe check when Spain was lost by the Western Roman Empire to the Visigoths, who, in turn, were succeeded by the Moors, that warlike race that held possession of southern Spain and Portugal, until driven out, late in the Fifteenth Century, by Ferdinand and Isabella. The San Domingos mines of Portugal, which were opened, certainly as early as Roman times, and, in all likelihood, by the Carthaginians, or their predecessors, the Phœnicians, were worked spasmodically during the middle ages, and were reopened in 1859, under modern methods.

The mines of Italy and Austria were small producers of copper in mediæval times, the most important Austrian mine being the Gratslitz, in Bohemia, which probably was the largest European producer about the Fourteenth or Fifteenth Century, but which was abandoned in the Eighteenth Century, though reopened, on a small scale, late in the Nineteenth. There are evidences that copper mines were worked in Bulgaria, and probably in Servia also, during the Roman era, and the Servian mines were small producers during the middle ages. There also was a little copper mining in Hungary during mediæval times, and possibly in Roumania also. Copper has been mined and smelted on a small scale in both European and Asiatic Turkey for some centuries.

In Germany, the Rammelsberg mines, in the Ober Harz, were opened circa A. D. 933, and have been producers for nearly a thousand years. The Mansfeld mines of the Ober Harz, opened A. D. 1199, have been fairly steady producers for 700 years, though with occasional hiatuses in output, due mainly to some of the numerous wars that were at once the business and the recreation of the middle ages. These mines made about 1500 long tons of fine copper in the days of Martin Luther, and were producers to about the same extent in 1860, but since have been developed into very large and successful mines, by the use of modern methods and equipment.

Stora Kopparberg, at Falun, Sweden, was opened A. D. 1228, and is claimed to have given to the world, to the end of the Nineteenth Century, not less than 1,200,000 tons of fine copper, remaining a small producer.

One of the earliest English mines was at Newlands, near Keswick, in Cumberland. This property was worked as early as A. D. 1250, and was working as late as A. D. 1470. The Ecton Hill mines, in Staffordshire, were among the earliest English copper mines after Newlands, and the tin mines of Cornwall were small producers of copper also, at least as early as the time of Queen Elizabeth, and probably for a century or

two earlier, though copper production on a large scale began with the Eighteenth Century. The copper mines of Anglesea, in Wales, were producers in Roman times, and were reopened in the Eighteenth Century, but have been idle since about the middle of the Nineteenth Century. In Ireland, mines worked during the Eighteenth Century and up to their closing in 1880, have been reopened, in an exploratory way, during the early years of the Twentieth Century. As early as A. D. 1586, copper ore was shipped to Anglesea for reduction, and in A. D. 1765 there were several smelters treating copper ore near Bristol. The Welsh smelting industry at Swansea seems to date from the Sixteenth Century. The first copper pennies of England were coined A. D. 1717.

At the beginning of the Eighteenth Century Great Britain was making at least three-quarters of the world's copper. The Cornish mines produced 4,923 tons of refined copper in 1799, and the Welsh mines of Anglesea made nearly 2,000 tons in the same year. The great Mansfeld mine, in Germany, made only 372 tons in that year, and only estimates are obtainable for the products of other countries. Spain's output was insignificant, and the United States made but a few tons. Russia and Japan probably ranked next in importance after England as producers, and Austria, Norway, Sweden, Italy and several other nations made small contributions to the world's copper stock. Australia, South Africa and Canada were then unknown as sources of supply. It is a notable fact that one hundred years ago, the mines of the United States, Spain, Chile, Mexico, Canada, South Africa, Australia and Tasmania, which now make about 90 per cent. of the world's copper, were either totally undeveloped, or else producers of but a few tons each, while Great Britain, which made almost 7,000 tons of copper in 1799, produced but 550 tons in 1899.

At the beginning of the Eighteenth Century the English mines, in Cornwall, were making much the largest part of the world's copper output, and even at that date were of such considerable depth, and with such extensive underground openings, that the problem of disposing of the water was of vital importance. Many good mines were allowed to remain idle, solely because the expense of keeping them free of water was greater than the profits of operation. The first steam engine was built for a Cornish mine, the Wheal Por, by a Captain Savery, very early in the Eighteenth Century. It was but a partial success, and the plan was improved on by Newcomen, who erected a pumping engine at the Wheal Fortune mine, Cornwall, in 1720. The Newcomen steam engine was a crude and wasteful device, according to the standards of the present day, but it was much more effective than hand and horse power, or a water wheel, and was used in many of the larger Cornish mines for fifty years or more, until the genius of Watt brought forth the modern steam engine. It should be said, however, for Savery and Newcomen, that crude as were their engines, the pumping plan followed by them was essentially sound, and the Cornish pump, first made by Savery two hundred years ago, and improved a little later by Newcomen, remains the basic model for the Cornish mine pumps, scattered over the habitable world, wherever there are mines.

The first Watt engine, erected at Chacewater, Cornwall, in 1777, proved a great success, and came none too soon, as the larger mines, deepened by reason of the aid given from Newcomen's pumps, were at a depth

where the first crude engines no longer could give satisfactory results.

Although steam power was first applied to copper mining two centuries ago, it was used only for handling water until after the beginning of the Nineteenth Century. The first application of steam power to other mining uses was in the first or second decade of the Nineteenth Century, when a hoisting drum was first actuated by steam.

For the first half of the Nineteenth Century, Great Britain maintained its position at the head of the world's copper producers, but for British copper mines the latter half of the century was a period of ever increasing depression, relieved by only occasional years of prosperity. The invention of the Watt engine and its application to pumping machinery enabled the mine operators of Cornwall and Anglesea to penetrate to depths theretofore undreamed of. In 1790 the Dolcoath mine, in Cornwall, was 600 feet deep; in 1816 it was down 1,368 feet, and in 1830 the Tresavean mine, also of Cornwall, reached the great depth of 1,920 feet. As the mines increased in depth rapidly, various improvements became necessary. The old method of raising ore in baskets, carried up ladders on the backs of men and women, was replaced by whims, operated first by hand, then by horse power, later by water-wheels, and eventually by steam, the ropes that hoisted ore in wicker baskets being coiled around these whims. A little later the hempen ropes were replaced by wire cables, and the baskets gave way to iron skips and cages. In 1842 the first man-engine was built, for taking miners to and from their work in the deep shafts. Mine surveying was introduced, and machinery employed in the mills, where hand-work had been the rule for centuries. The Anglesea mines enjoyed great prosperity for the first quarter of the century, but gave unmistakable signs of exhaustion a few years later, and in the fourth decade ceased to be important factors in the world's copper industry. The smelters of Wales had attained such growth, however, that Swansea still remains the seat of one of the greatest and most diversified smelting industries of the world.

Apparently the first copper mining was done in Japan circa A. D. 700, but the industry did not become important until about A. D. 1600, and in the Seventeenth Century, more or less copper was exported to Europe, through the medium of the trading ships of the Dutch, who enjoyed a monopoly of Japanese trade, until the excesses of the traders and missionaries lead to the closing of the ports in Japan to all foreign trade, after which Japan was a sealed book to the balance of the world, until reopened by Commodore Perry, in 1854. In 1830 the production of Japan was about 4,000 long tons, and in 1874 was only 3,360 long tons, of which four mines furnished about half, and nearly 200 mines the other half, giving an average annual production of about 10 tons only for the smaller mines. Modern Japan may be said to date from 1869, when the Tokugawa government was deposed, and the Shogun was compelled to surrender his usurped power to the Mikado, the rightful ruler. The readjustment of internal political affairs occupied the attention of the Japanese, almost to the exclusion of other matters, for some years, but about 1880 the task of readjusting the ancient economy of the empire to modern environments was begun in earnest, and from that year, in which the first modern mining and smelting machinery was introduced to Japanese

mines, may be said to date the beginning of the present copper industry of Nippon—an industry that has made gigantic strides, and which is well equipped and conducted upon as modern methods as can be found in any country on the globe. Since 1890 the progress has been steady and rapid.

As early as the Sixteenth Century, copper was discovered in Cuba, Mexico, and several of the South American countries, but the Spanish conquistadors were more anxious for the gold of the Peruvian Incas and the silver from Potosi and Guanajuato, than for the baser metals, hence the production of copper in Spanish America remained trivial, being merely sufficient for local needs, until about the middle of the Nineteenth Century. In Chile a little copper mining was done during the Eighteenth Century, but the inception of the great copper mining industry of that country may be said to date from about 1840, when the systematic development of the great copper measures of Chile was undertaken along modern lines.

Argentina first became a producer of copper about 1856, but never has become a large factor in the industry, though possessing copper fields of promise, which doubtless will be heard from in the future.

In Mexico, copper was mined and smelted in a crude way, and to a very limited extent, by the Aztecs. A little metal was produced under Spanish domination, but the Mexican copper mining industry did not become important until about 1880, the profits of silver mining having blinded the miners to the possibilities of great returns existing in the baser metals. Mexico now ranks second only to the United States among the copper producing fields of the world, and its present large production is but an earnest of future possibilities, practically unlimited in extent.

In Cuba, copper mining was begun in the Sierra Madre Mountains, near Santiago, during the Sixteenth Century. These mines were reopened early in the Nineteenth Century, and secured a considerable tonnage between 1817 and 1868, the principal production being after 1834, when the various mines were bought and consolidated by an English company, annual production averaging about $1,000,000 in value, until the rebellion of 1868, when the plant was burned by insurgents.

In the United States, copper was discovered in Massachusetts as early as 1632, and in 1709 a company was incorporated in Connecticut, for the purpose of working copper ores. The copper deposits of New Jersey were exploited as early as 1719, but the copper mines of Vermont, dating from the Eighteenth Century also, remained the principal source of American production until the opening of the Lake Superior mines in 1844. A promising copper industry was begun, circa 1850, in Tennessee, but was destroyed by the American Civil War, and was not rejuvenated until nearly forty years later.

Really important copper mining in the United States dates from 1844, when the first production, a few tons of black copper ore, probably chalcocite, was taken from a fissure vein near Copper Harbor, Keweenaw County, Michigan. The beginnings of the Lake Superior industry were crude, but the growth was fairly steady from the start, and within two decades the Lake Superior mines became the most important producers of the United States, and second only to the mines of Chile, which were passed in the ninth decennium of the Nineteenth Century. The existence

of the rich stores of native copper in the Lake Superior district was known to the aborigines, and these mines had been worked by some prehistoric people that left considerable traces of their extensive operations. In 1882 Montana, now the largest copper producing district of the world, made its first production of the metal, and the beginnings of the great copper industry of Arizona were a decade earlier.

In British North America, Newfoundland opened its first mines of importance in 1865. A little mining of cupriferous pyrites was done shortly afterward in the Province of Quebec. Copper mining in the Province of Ontario begun with the opening of the Bruce Mines in 1846, but really important copper production dates only from the exploitation of the great nickel-copper deposits of Sudbury about 1886, and the large and promising copper industry of British Columbia had its inception in the last decade of the Nineteenth Century.

In Northern Africa the mining of copper ore, along the shores of the Mediterranean, dates from prehistoric times, but in Southern Africa the industry had its inception in the opening of the O'okiep mine, in Little Namaqualand, Cape Colony, in 1852, though copper had been discovered late in the Seventeenth Century by the Dutch settlers, and some fugitive efforts made in the direction of mining. The exploitation of the copper resources of Central Africa, still at an early stage of development, dates from the closing years of the Nineteenth Century and the same remarks hold true regarding the copper measures and mines of German Southwest Africa. The first recorded production of Australian mines was in 1844, and it is probable that in the future Australia will become a much more important factor in the copper market than has been the case in the past.

In Asia, copper mining and reduction, along very crude lines, have existed for unknown centuries, in China, India and Persia. The copper measures of China are of much promise, and this ancient empire, now awakening to the light of Twentieth Century civilization, doubtless will become a large producer of this necessary metal during the present generation.

The copper industry of the Twentieth Century may be said to date practically only from about the middle of the Nineteenth Century. Of the leading copper producing fields of the world, Lake Superior, Montana, Arizona and Utah, in the United States, were unknown in 1840. Mexico, which now holds second place as a producer, made no copper worth mentioning previous to the last quarter of the Nineteenth Century. The present great copper industry of Canada is so recent that all of its principal developments have occurred since 1880. The copper production of Australasia and South Africa date from about the middle of the Nineteenth Century, and production along modern lines, and on an important scale, in Chile, also began about 1850. Of the really important copper producing fields of the world, only Spain, Germany and Japan have a history that is not covered by the span of life of a man of three score and ten.

The beneficial influence of the copper industry upon the mining and metallurgical methods of the world has been most marked, and the copper industry has been well to the fore in the introduction of improvements. Gunpowder for blasting was first used at Frieberg, in 1610, and was

introduced at the Wheal Vor mine, in Cornwall about 1670. Steam for pumping and later for general use, was first introduced to mining at the copper properties of Cornwall. Wire rope and iron buckets for hoisting were first used in copper mining, and high explosives and power-drills for breaking rock were first used in the Lake Superior mines. The history of the metallurgy of copper for the past quarter century is almost coincident with the history of metallurgy as a whole for the same period.

Various attempts have been made to corner the production of copper since it became a metal of prime importance. The first attempt along these lines was made by the Associated Smelters of Swansea, which perhaps was the original copper trust. The Associated Smelters, which flourished from 1840 to 1860, was most arbitrary in its operations, buying as cheaply and selling as dearly as possible, and zealously guarding its smelting processes. The short-sighted policy of this association, in screwing prices of ore to the lowest possible figure, while advancing the price of the finished metal, aggravated by its arbitrary charges for draftage and moisture, and by the use of unfair assay methods, led to the establishment of independent smelters at or near the mines, in most of the principal copper producing districts, and effectually shattered the power of Swansea as the arbiter of the copper industry.

The second attempt at a copper corner was made by a group of French financiers, under the leadership of M. Secretan. The basis of this corner was the Société des Metaux, of Paris, formed 1877, which in February, 1887, became one of sixteen underwriters that organized the Secretan Syndicate, with a nominal capitalization of $13,587,000, eventually reduced to $10,718,500. Of this capitalization, the Société des Metaux held $2,910,000, and M. Secretan, personally, $2,328,000. The Comptoir d'Escompte, which then was second only to the Bank of France, among French financial institutions, became involved, first through guaranteeing purchases from the mines, and later through loaning funds to the Syndicate, originally upon the security of the metal itself, and latterly upon endorsements. The first step of the Secretan Syndicate was to secure control of the production of the Anaconda mine, in December, 1887, the Anaconda being, at that time, the largest copper producer of the world. This was followed shortly by the making of contracts with the Calumet & Hecla, Rio Tinto and other large mines producing at least 75 per cent., and probably as much as 85 per cent., of the copper output of the globe. At the end of August, 1888, the Syndicate had borrowed $24,825,000, and at the end of December, 1888, the Comptoir d'Escompte had loaned to the Syndicate the enormous sum of $33,368,000, of which only $16,878,000 was fully secured. The price of copper was advanced, speedily, by the Syndicate, from 11 cents to 17¾ cents per pound, this advance taking place within one month. Consumers, understanding the situation fully, reduced their demands to the lowest possible figure, and an immense amount of old copper was broken up and resmelted, the available supply of old copper proving vastly greater than had been anticipated by anyone, and forming perhaps the largest single factor in causing the downfall of the Secretan Syndicate.

Very early in 1899 the credit of the Syndicate was exhausted, and the Comptoir d'Escompte was so seriously involved that the manager

committed suicide, and the bank was saved with great difficulty, while the Secretan Syndicate was demolished utterly. Notice of the failure of the syndicate was followed by an immediate drop, from the market price of £100 per long ton of copper, and, in a single day, in the spring of 1889, copper dropped £70 to £35 per long ton. The bankers, who had loaned immense sums upon copper stored in bonded warehouses, decided to sacrifice their holdings, at any price that would enable them to realize upon their collateral, but, through the action of the Calumet & Hecla, backed by the Anaconda, which threatened to put the price of copper to five cents per pound, unless the bankers would spread the marketing of the surplus over a period of years, utter paralysis of the copper trade was averted. The accumulation of copper made by the Secretan Syndicate, in a period of about eighteen months, has been estimated variously, but may be set down safely at about 175,000 long tons. A period of four years was required to work off this accumulated surplus, which was marketed without serious disturbance to the trade, though entailing six years of low prices for the metal.

The third attempt at a copper corner was made in February, 1899, by the organization of the Amalgamated Copper Company, avowedly formed with the intention of controlling, first the American, and, later the world's copper trade. This corporation was organized with a controlling share interest in the Anaconda, and several other smaller mines of Butte, to which, two years later, was added the Boston & Montana mine. The Amalgamated Copper Co., operating through its sales agency, the United Metals Selling Co., maintained the price of copper at 17 cents per pound until October, 1901, when it was seen that a break in prices was inevitable, and at which time nearly 200,000,000 pounds of copper had been accumulated, this being owned mainly by the Amalgamated Copper Co., and by its subsidiary and affiliated producers. A panic in the copper market was precipitated by the action of the United Metals Selling Co., in making repeated cuts in the price of the metal, at regular intervals. The Amalgamated was credited, popularly, with the intention of cutting the price of the metal squarely in two, to 8½ cents per pound. This price was not reached, however, for the reason that several of the large independent producers, led by Phelps, Dodge & Co., aided by several of the largest American consuming interests, stepped in and bought up all of the surplus copper remaining in the market, at prices around 12 cents to 13 cents per pound.

Early in 1907 an effort was made, by strong interests, to form a combination to include the leading American producers, with a view to maintaining prices through regulation of marketing, and by restricting production if necessary, but this effort was frustrated by the stand taken by several leading independent producers of the United States.

Further and more detailed particulars regarding the history of mining and metallurgical developments will be found in the chapters devoted to metallurgy and to the copper deposits of the world, in addition to which detailed references to the history of individual mines will be found in the descriptions of many of the more important copper properties, contained in the long chapter devoted to copper mines.

CHAPTER II.

The Geology of Copper.

Merely an outline of geological features of interest pertaining to copper is attempted in this chapter. The subject is so great that many books of value have been written upon the matter by different authorities. From its very nature, geology is largely an empirical science, but the Twentieth Century geologist is a vastly better-fitted worker, in his chosen field, than his predecessor of even the preceding generation. The geological work of the Nineteenth Century, until well toward its close, was largely of a synthetical nature, but the new school of geology teaches, and with wisdom, that analysis must precede synthesis. As a consequence of this new spirit, great strides have been made in geological knowledge, and in the special field of copper, much work of a brilliant and highly valuable nature has been done during the few years of the present century. The work of Weed, Winchell, Kemp, Lindgren and other scientists of solid attainments and indefatigable industry has added greatly to our sum of knowledge of the geology of copper. The geologist, who was regarded, fifty years ago, by practical men, as belonging to much the same class of pseudo-scientists as the alchemist, has made for himself, through sound work, a safe place in the ranks of the technical men whose labors are of practical, as well as of theoretical value, to the world.

There is much diversity of opinion, on various important points, among the leading geologists of the present time, but out of this turmoil of argument and confusion, is arising a newer and a sounder knowledge of geology, not only in theory, but in its vital bearings upon the industry and civilization of the world, so fundamentally dependent upon an assured supply, at reasonable cost, of the important metals and minerals.

Rocks may be divided into three classes, these being igneous, sedimentary and metamorphic. The igneous rocks, fused in the bowels of the earth, and ejected by volcanic action, or oozing forth as magma from cracks in the earth's crust, may be divided into granitic, porphyritic, vitreous and tufaceous forms, this latter division including the tuffs ejected as scoriaceous material, by volcanic action. The sedimentary rocks were deposited by the action of water, usually on the beds of ancient seas. The detrital material so deposited formed conglomerate, shale, sandstone and limestone strata, and, in the case of the three forms first named, the material for sedimentary beds was obtained necessarily, mainly from the breaking down of the older igneous rocks. Strata of igneous and sedimentary rocks frequently alternate in the older geological groups. The third, or metamorphic class of rock forms, consists of altered rocks of both the igneous and sedimentary forms, in which the phenomena of crystallization and replacement have been brought about since their formation

by the action of intrusive deposits of molten magma, and by the effects of percolating waters, whether meteoric or volcanic.

The ores of copper are described in detail in the chapter on chemistry and mineralogy, but some brief reference thereto is necessary in an outline of the geology of the metal. The principal copper ores of commercial importance may be divided into seven classes, as follows: Native copper, existing alone, or practically so, in the Lake Superior district, Bolivia and elsewhere, and occurring in the oxidized zone of mines of copper ore in almost every mineral field; oxide ores, including cuprite and melaconite; carbonate ores, including malachite and azurite; sulphide ores, of which chalcocite, bornite and chalcopyrite are the more important; chalcanthite, or sulphate of copper, occurring as an alteration product in many rich sulphide mines, and being the source of the copper secured by precipitation from cupriferous mine-waters; enargite, among the arsenides, and atacamite among the chlorides. In importance, the sulphide group is overwhelmingly preponderant, about three-fourths of the world's copper supply coming from ores of this class. Contrary to the opinion formerly held, chalcocite is a far more important source of copper supply than chalcopyrite, and bornite probably is but slightly behind chalcopyrite, as a source of copper supply from the sulphide ores. It is probable that chalcocite, which is the most important ore of copper, produces nearly one-half of the world's supply of the metal.

The copper ores are very showy, giving nearly every color of the spectrum, hence attract attention more readily than most ores of other metals, but nature has so deposited many of our most important stores of copper, as hereinafter described, that the outcrops first visible to the discoverer are merely rusty stains of hematite and limonite, both ores of iron, with colors ranging from yellow through brown to red, these outcrops occasionally carrying small quantities of green and blue copper carbonates.

The industrial metals known to man have varying affinities, this referring not only to their valencies, as determined by their position among the elements, but also referring to their preference for combining with other elements, and furthermore to their choice of neighbors, this latter depending, necessarily, largely upon the material available. It is found, however, in geological and mineralogical research, that certain groups of metals may be looked for in juxtaposition, under given circumstances. Gold, the king of metals, and platinum, scarcely the inferior of gold, hold themselves aloof from the common herd, and occur but rarely as ores. Silver is more democratic, and the common workaday metals are found commingled in a spirit of fellowship, but, as in the social fabric of man, there are certain family relations, and cleavage lines by which classes are formed.

Most copper deposits carry both gold and silver, usually in small quantities, but frequently in sufficient amounts to add materially to the gross values recovered, especially since the very general utilization of the electrolytic process for copper refining has made it possible to recover the precious metal values, practically without cost, while eliminating the impurities remaining in the blister copper turned out by the smelters. Lead and zinc are found very commonly in connection with copper ores,

the three sulphide ores of copper, lead and zinc, being closely affiliated, and iron, while rarely considered a commercial product of copper ores, is found in the great majority of copper mines, first as the iron hat, marking the outcrop of the vein, and in the lower workings of the mines, chemically united with copper and sulphur, as chalcopyrite, or, as is frequently the case, intimately, but mechanically, associated as chalcocite and pyrite, the sulphide ores respectively of copper and iron. Arsenic and bismuth also are common associates of copper, these being deleterious elements. Zinc also, mechanically mixed with many copper sulphide ores, is a damage, and its presence has prevented the successful development of many otherwise valuable copper mines. Only within the past few years has it become possible to mechanically remove zinc from sulphide copper ores, previous to smelting.

The more common metals, and frequently the rarer ones, are found as component parts of many ordinary igneous rocks, though commonly in such small quantities that these rocks cannot be considered as ores of even the lowest grade. There are notable exceptions to this rule, as in the case of the monzonite ore bodies of Bingham, Morenci and Ely, and it is probable that in the future other sources of copper supply, of the first magnitude, will be found in igneous rocks, in which the original cupriferous contents have been enriched by local action. The enrichment of the monzonite ore bodies referred to, seems to have been due to the shattering of the soldified upper portions of the cooled magma, containing originally a small quantity of magmatic copper concretions, followed by the precipitation of additional copper, in the form of chalcopyrite, from the heavily mineralized magmatic vapors rising into the shattered zone from the still molten mass below. This process may have been aided by later enrichment from percolating waters, which would tend, however, as a rule, to extract the mineral values disseminated throughout the rock-mass, and segregate these values in fissures in the igneous rocks, or along the line of contact with adjacent sedimentary or metamorphic rocks.

In the light of present geological knowledge, it seems probable that the original source of most of the present workable copper deposits was in chalcopyrite disseminated sparingly, in minute particles, through the magma of igneous rocks. From these disseminated particles of chalcopyrite, most of our copper ore bodies have been formed, either by magmatic segregation, in which the greater part of the ore values was deposited, usually at the point of contact with adjacent rock forms, or by leaching therefrom. Nature is much the greatest chemist and metallurgist now doing business, and the work of her laboratories and forges, while exceedingly slow, is upon a vast scale, and never ceases. The sulphide ore values, contained originally in molten magma, have been reconcentrated, and redeposited, repeatedly in many cases, during the millions of years that have elapsed since the work was begun, consequently the miner finds ores existing in a great variety of forms, and giving evidences of complicated chemical reactions, as well as of long continued mechanical concentration.

In a complex magmatic intrusion, the edges of the intrusive mass naturally cool first, through the radiation of heat to adjoining rocks, and, in addition, the less soluble minerals are the first to crystallize. Copper,

having a greater affinity for sulphur than is possessed by any other metal, is one of the first minerals to crystallize out of the molten magma, as chalcopyrite. These facts afford an explanation of the occurrence of magmatic ore bodies along the point of contact between igneous intrusives and the rocks so intruded. Many of the best workable bodies of copper ore are found at or near the contact between granitic intrusions and sedimentary or metamorphic strata adjoining, occurring either as contact deposits, or, frequently, in fissures traversing either or both the igneous mass and the adjoining strata.

Many important bodies of copper ore occur as contact metamorphic deposits, at or near the contact between intrusive rocks and stratified formations. While the exact genesis of these ore deposits varies according to circumstances, and frequently remains somewhat obscure, the main point of magmatic segregation seems sufficiently plain, and much corroborative evidence has been brought to light by recent investigations. These deposits may be separated roughly into two classes, the first being products of simple metamorphism, with slight changes in ore bodies previously laid down, while the more important, and probably more common class, is attended by contact metasomatism, due to reactions caused by vapors and magma emanating from the intrusive rocks. Where such ore bodies are deposited in limestone, which frequently is the case, further alterations and reactions of prime importance have followed the cooling of the igneous rock, in many instances, the limestone offering an exceptionally suitable reagent, in connection with percolating waters, for further chemical changes in the nature of the ores.

Rain, falling upon the surface of the earth, carries small quantities of oxygen and carbonic acid gas, both weak solvents of many minerals. The weakness of the solvents has been fortified by the immense quantity of rain so falling, and by the lapse of untold millions of years, during which the process of leaching has been continuous. When attacking primary sulphide ores, such as chalcopyrite or pyrite, the water carrying oxygen and carbon dioxide in solution, eventually sets free an atom of sulphur, which, combining with the water, forms a dilute sulphuric acid, very weak to be sure, but a much more powerful solvent than carbonic acid gas or oxygen, and the weak sulphuric acid solution reattacks the sulphide ores, gradually breaking them down, and taking them into solution, and they are redeposited, at suitable points, lower down, as enriched sulphides, carbonates and oxides, and occasionally as native copper. The synthesis of most of the important ores of copper has been fairly established by extended and successful laboratory reactions.

The important part played in ore deposits by water is now acknowledged by all geological authorities. In fact, it is a question if the importance of the work done by water in forming commercial ore bodies is not over-rated by some geologists. While the work of water in laying down ore bodies is generally acknowledged, there are considerable differences of opinion as to whether deposition has come mainly from waters of meteoric or of volcanic origin, and also whether the ore was deposited mainly from descending or ascending waters. There seem excellent grounds for believing that both descending and ascending waters have played very important parts in depositing mineral values. The rains that fall upon

the surface of the earth sink into the rocks to great depth, there being practically no rock formations that are impervious, though the degree of permeability varies greatly. For all practical purposes the rocks composing the earth's crust may be considered permeable by water to the depth where increased temperature vaporizes it. That percolating meteoric waters have been responsible for a considerable proportion of the ore bodies now in existence seems reasonably assured, but that the meteoric waters have been, in many cases, greatly assisted by terrestrial waters, ascending from great depth, strongly charged with metallic solutions, also seems a hypothesis fully warranted by known facts. The terrestrial ascending waters naturally would possess the advantage of heat, to a degree adding greatly to their natural solvent power, and the pressure existing at great depths also would add largely to the solvent power of such waters.

In addition to the primary force of magmatic segregation, and the secondary force of waters carrying minerals in solution, there are other genetic forces of lesser, but by no means negligible importance. That organic matter has played a considerable part in the precipitation of copper minerals is shown plainly in numerous instances. There also is a theory, now in rather general discredit, that metallic values have been precipitated by electro-chemical action, from sea-water. The water of the ocean contains a very small quantity of copper, probably less than one grain in one hundred cubic meters, but, in the aggregate, the seas hold an enormous amount of this metal. Apparently the sea was the source of the metal found in cupriferous shales at many points on the earth's surface, and there is corroborative evidence that the native copper found in the Keweenawan belt of Lake Superior may have been precipitated in metallic form by the action of sodium chloride, the ferrous condition of the small quantities of iron found associated with this native copper seeming to substantiate this view.

Another theory, once widely held, but now in general disfavor, is that the metals were deposited by electrical action. In all likelihood, electricity, which seems but another name for all energy, whether dynamic or static, was not devoid of power in the great work of concentrating mineral values from the original disseminated particles contained in rock magmas, to the point of sufficient richness to be available for the uses of man.

An evidence of the truth of the hypothesis that mineral values have been deposited from heated ascending waters is furnished at a number of points on the earth's surface by hot springs, that are now depositing copper in small quantities. Not the least interesting of these is a hot spring in Java that carries in solution copper iodide, which is concentrated and produced commercially on a small scale.

Clays possess the power, through adsorption, of extracting metals from wonderfully dilute solutions, and it has been ascertained that all clay-shales are more or less cupriferous, though usually valueless as ores. Copper is a peculiarly soluble metal, in most of its compounds, which are largely associated with iron sulphides, hence easily attacked by oxidizing waters. Carbonaceous and organic matters are powerful reagents, and lead to numerous reactions, in connection with the oxygen, carbon dioxide and dilute sulphuric acid found in underground waters.

Copper, nickel and cobalt are found frequently in basic gabbros, in many parts of the world. The Lake Superior traps are of this class, as a rule, and copper, in small amounts, is found as impregnations in dense dioritic rocks, and in uncomformable adjacent sandstone of a later geological horizon, near the point of contact, where there are some evidences of metamorphism. The home of the Lake Superior copper, however, is in the metamorphic amagdaloidal traps and conglomerates, and in the sandstones of the upper Keweenawan series. Native copper is found frequently in greenstone, as in the amygdaloids of Lake Superior, in the Nicholai deposits of the Copper River district of Alaska, in the melaphyrs of Newfoundland, in Amador and Calaveras counties, California, and at a number of other points.

Various classes of copper ore deposits are found, these including magmatic segregations, metamorphic contact deposits, fissure veins and deposits formed by percolating waters and mineralized vapors, replacements, sedimentary deposits, and impregnations in sandstones, tuffs, conglomerates and breccias. While these various classes of deposits are distinct, in theory, and usually distinguishable in practice, the lines between individual deposits are extremely difficult to draw in some cases.

While some ore bodies are entirely covered by flows of later geological age, and while some of the contact deposits in stratified rocks, notably in limestone, show very small outcrops, as a rule there are strong surface indications of cupriferous values at depth. Occasionally the unaltered sulphide ores outcrop at surface, as in the case of deposits of disseminated chalcopyrite in the Algoma district of Ontario and elsewhere, and in the instance of the magnificent surface croppings of massive bornite, chalcocite and chalcopyrite found in the Copper River district of Alaska, the latter probably being the richest outcrops ever discovered. As a rule, however, a copper-bearing fissure vein or contact deposit shows a gossan, or iron hat, this deriving its color of rusty yellow, brown or red, from iron in the form of hematite or limonite. The gossan may, and frequently does, show copper ore, usually as carbonates, either both malachite and azurite, or more commonly, the green carbonate alone, and occasionally there are other oxidized copper ores shown in the gossans, but, as a rule, these carry but small copper values, and rarely can be considered commercial ores of copper, though in numerous cases the gold contents are sufficient to warrant their working as gold mines. In fact, many mines have been opened for gold that really contained immensely greater values in copper, at depth, and there are frequent instances of gold mines turning into copper mines at depth, the most recent example of importance of this change in metallic values being afforded by the Mount Morgan mine, of Queensland, Australia, for many years one of the largest gold producers of the world, and now a copper mine of great value, at a depth of 1,000 feet or more.

Frequent reference is made to the silver mines of Butte turning into copper mines at depth, but this is somewhat misleading. The first mines at Butte were silver properties, and there seems good reason to believe that some of these may turn into copper mines at great depth, but, as a matter of fact, the silver mines were opened on an entirely different set of veins than those carrying the wonderful copper values for which

Butte is famed, and the discovery of the copper mines was due to cross-cutting, at depth, from the mines on the silver veins, as the copper veins contain practically no values for 500 to 1,000 feet depth from surface. Some of the greatest ore bodies at Butte have no gossans, and surface indications are most meagre, not being sufficient to justify the expense of exploring, in an unproven district.

Examples of silver-lead mines turning into copper properties at depth are fairly numerous in Utah, Mexico and elsewhere, probably the best examples being furnished by the mines of the Bingham district of Utah. At Leadville, Colorado, the zinc ores of the upper workings are being replaced by copper at depth.

In the majority of cases the outcrops of copper ore bodies are leached, and, in such cases, only infrequently give workable values in copper at surface, though, as before stated, there are numerous instances of gossans carrying workable gold values, causing the opening of gold mines that at depth have turned into copper mines.

As chalcopyrite, which may be considered the original form of copper ore, carries one atom of iron, and one of copper, held together by two atoms of sulphur, the breaking up of the granule of chalcopyrite not only releases copper, for redeposition in the form of an enriched sulphide, or as a silicate, carbonate or oxide ore, but also releases the atom of iron, which may be carried upward or downward, or left in place, and which usually appears as hematite, the sesquioxide of iron, or as limonite, the hydrated sesquioxide, disseminated through the outcrop of the vein. This is the gossan or iron hat, a welcome sign of probable copper values below, in nearly every copper mining district of the world. It is not, however, an invariable indication of workable values at depth, and there are numerous instances where fine gossans, of the most promising appearance, have proven deceptive as to values carried in the vein beneath. These gossans also have the bad habit of spreading beyond the limits of the walls of the vein below, through lateral surface filtration, and occasionally a wide gossan covers a narrow vein. At other points the original gossan has been removed by surface erosion, or by glacial action, but, as a rule, a good gossan means at least a fair chance of a good mine beneath.

The depth of gossan cappings varies greatly, according to local circumstances, occasionally being merely superficial, but sometimes extending to the water level. In the case of a typical cupriferous fissure vein with a typical gossan, the iron capping is succeeded by a leached zone, and where the leaching has been long continued and thorough, and erosion light, the mineral values have been removed, almost completely, from the leached zone, to be redeposited at greater depth. In other instances, the leaching has been less thorough, and copper values, usually small, remain in the leached area. The depth of the leached zone varies greatly, according to the circumstances following the first deposition of the ore, and occasionally the leached zone is of great depth, as at Butte, while elsewhere it is comparatively shallow, and sometimes is lacking entirely. The great depth of the leached zone in Butte, and the great depth and richness of the succeeding zone, afford evidence in support of the palpable hypothesis that, under average circumstances, the greater the depth of leaching, the greater the quantity of secondarily enriched ores to be found below.

The typical cupriferous fissure vein may be divided into five zones. The upper is the iron hat or gossan outcrop, succeeded by the leached zone. The third zone is that of oxidized ores, carrying rich oxides and carbonates, and occasional silicates and chlorides, followed immediately by the fourth zone, carrying enriched secondary sulphides, such as chalcocite and bornite, with occasional covellite. The limits between the zone of oxidized ores and that of enriched sulphides are not always clearly defined, and these two zones frequently are considered as one, under the name of the zone of secondary enrichment. It is, however, possible to draw a rough line of demarcation between the oxidized ores above and the enriched secondary sulphides below, in this so-called zone of secondary enrichment, in most cases. The source of the copper in the enriched zone is, of course, the values leached from the vein above, and here redeposited. The depth of the zone of secondary enrichment varies enormously, being dependent upon a considerable variety of factors, including the average percentage of copper in the original vein, the depth to which leaching has been carried, the amount of surface erosion, and the time that has been consumed. In some of the mines of Butte the zone of secondary enrichment is of tremendous depth, a strong vein of massive chalcocite having been found at a depth of 2,400 feet in one of the Anaconda mines.

In the fifth or final zone, the ore is chalcopyrite, sometimes massive, but more commonly disseminated, and usually associated with pyrite, or chalcocite in thin films, as coatings on grains of pyrite. In this zone, values gradually decrease with depth, until the vein pinches out, or, as is more commonly the case, carries lessening values that lead to the abandonment of the property as unpayable.

Bonanza ores in the zone of secondary enrichment sometimes hold to great depth, but, usually are comparatively shallow, the most important exception to this rule being in the case of the deep mines at Butte, previously referred to. The zone of secondary enrichment sometimes carries silicate and chloride ores of copper, as the results of various reactions. Where the unaltered ores in the final zone are argentiferous, copper ores rich in silver occur in the zone of secondary enrichment. Copper ore bodies frequently carry the native metal in the zone of secondary enrichment, where crystals of cuprite shade into crystals of native copper. Masses of native metal of hundreds, and even of thousands of pounds in weight, occur in many of the well-known copper ore mines, but such masses of native metal must be held radically distinct in genesis from the native copper of Lake Superior.

The influence of wall-rocks seems of considerable weight in determining the nature of secondary deposits. Where the wall-rocks are silicious, the products of secondary enrichment, in the sulphide zone, usually are chalcocite and occasionally covellite, while limestone walls are apt to give more or less chrysocolla in the oxidized zone. Chalcocite is especially liable to occur in veins traversing silicious rocks, but frequently is found in considerable quantities in limestone deposits. The copper and tin deposits of Cornwall afford an interesting field for speculation in this connection. According to the best authorities, these metals were given off from granitic magmas, in the form of gases, heavily laden with metallic vapors, which deposited the tin and copper in the same veins, but with a

fairly sharp line of demarcation, the copper occurring mainly in those portions of the fissures that traverse slate, while tin usually occurs in granite.

The most common gangue of copper ore is quartz, which also is true of many other metals. Calcite and spathic iron ore frequently are found also, and occasionally barite. Very commonly the gangue is merely altered country-rock.

All copper ore bodies, including the native copper mines of Lake Superior, notwithstanding a general impression to the contrary, show decreased values at great depth. The exact depth at which the permanent decrease begins depends, necessarily, upon many factors, and no general rule, other than the one herein laid down, can be predicated.

Deposits of copper ore, of size and tenor sufficient to warrant ranking them among commercial ore bodies, may be considered, as to occurrence, by three widely differing methods of grouping. The first of these is geographical, and, while, for commercial reasons, the geographical occurrence of copper is of prime importance, and is treated of fully in later chapters covering the entire world, under the title of Copper Deposits, such a grouping is essentially commercial, and by no means in accordance with geological rules, for the reason that the geographical divisions of the earth have been made by man, hence rarely correspond with the geological divisions made by nature. The two other methods of grouping occurrences of ore may be termed the method of geological horizons, and the lithological plan. It is necessary, in order to afford even an outline of the geology of copper, to give brief consideration to occurrences grouped under both of the latter-named headings. Viewed by geological ages, it is noted that copper deposits occur in rocks of practically all periods except the Quaternary, but the ore bodies are mainly post-Cretaceous deposits of Devonian and Carboniferous ages, laid down in rocks of those or of previous ages. The Permian veins throughout the world are notably cupriferous, and furnish a number of mines, though many of the Permian beds are too low in copper tenor to be considered as available deposits, at the present time, though doubtless these will have their place in the economy of future generations. The rocks of the Permian age, and the Jura-Trias system of the Mesozoic, or age next younger than the Permian, are more uniformly cupriferous than those of any other period, but are apt to carry disseminated ores of very low copper tenor, and these are workable only in occasional spots of exceptional richness, usually due to local enrichments caused by igneous intrusives. While the percentage of copper in the Permian and early Mesozoic beds is small, the aggregate of copper so deposited is past computation, owing to the dissemination of the ores through beds of vast area.

Viewed from a lithological standpoint, workable ore deposits occur mainly in igneous areas, most usually at or near the point of contact between igneous intrusive rocks and stratified beds, limestone being the most common form of the latter, but a number of the largest deposits now worked, including those of Lake Superior, Butte and Mansfeld, are of other classes. Very many of the principal copper deposits now worked are closely connected with intrusive granite rocks, of post-Cretaceous age.

Like most workable deposits of practically all other metals found in place, copper occurs in mountain ranges, perhaps more frequently in the

flanks or the foot-hills than in the higher peaks. In frequent instances, as in the Lake Superior deposits, copper is found in the roots of very ancient mountain ranges that have been quite thoroughly eroded. Many of the largest copper deposits are found at or near the point of contact between igneous intrusives and other rock forms, leading necessarily to the assumption that the metallic values were contained originally in the granitic magma, and either were deposited as magmatic segregations, at or near the point of contact, or, as is more commonly the case, were leached from the magma and redeposited as concentrated ore in fissures and limestone cavities, or as impregnations in permeable rocks. Primary ores usually are associated with basic rocks, or may be contact deposits of igneous acid rocks, but the secondary ores may occur in any adjacent rock strata offering a place for their deposition.

There are occasional occurrences of magmatic copper ores not existing as segregations distinct from the magma, though such deposits offer evidences of strictly local segregation, but most of these cases are of scholastic rather than of commercial importance. Exceptions must be made, however, in the instances of the wonderful monzonite ore bodies of Bingham, Utah, and of Ely, Nevada, and of a portion of the deposits of Clifton and Morenci, in Graham county, Arizona. It is probable that in the future greater attention will be paid to the possibilities of discovering similar porphyritic ore bodies containing magmatic ores, low in copper tenor, to be sure, but immensely valuable because of the almost unlimited quantity of such ore that may be found to occur in a single deposit.

The districts carrying copper in sedimentary formations are low in copper tenor as a rule, but more extensive in area than those fields carrying copper in igneous and metamorphic rocks. The Mansfeld district of Germany covers about two hundred square miles, and the Permian formation of the Ural Mountain range, that separates Russia and Siberia, is very extensive on both flanks, covering several thousand square miles. The Lake Superior copper district is of an exceptional nature, and of unusual extent, having a known length of about 400 miles, from Michipicoten Island, on the east to Pine and Chisago counties, only a short distance north of Minneapolis and St. Paul, on the west, but nearly half of this distance is submerged under Lake Superior, between the western end of Michipicoten Island and the eastern tip of the Keweenaw Peninsula. The present limits of exploitation include a strip of about 100 miles only in length, the Keweenawan series having a width of 2 to 8 miles, and being flanked by beds of sandstone.

Copper is found in practically every class of mineral deposit known to miners, and, in Alaska, and elsewhere, occurs as native stream metal. Copper deposits of more or less value are found in nearly every country on the globe, but many of these are not of sufficient value to justify present working, though what the future may have in store, when the world demands more tons of copper yearly than it now requires tons of pig iron, the best of prophets scarcely could foretell. Copper ores frequently occur in lenticular form, some lenses, as in the case of the Rio Tinto mine, being of immense size, but some of the ore deposits formerly classed as beds are now rated, in view of later and more exact knowledge, as veins.

In the commercial exploitation of copper ore bodies, one of the most

common and most fatal of errors is in attempting to base the future of the mine upon the rich and easily smelted ores of the zone of secondary enrichment. The wise management endeavors to learn the nature and extent of its ore bodies at depth, before building large and costly reduction plants of a permanent nature. When a mine is already opened in rich copper ores, sinking always is a good policy. Only by sinking to depth can the future of the mine be predicated with safety, and only by determining the different kinds and grades of ore, and the proportions in which they exist, can permanently satisfactory reduction plants be planned and installed.

Detailed information regarding the distribution of copper ores throughout the globe, with numerous detailed references to the geology of copper, will be found in the various chapters devoted to the geography of the metal. Geological particulars regarding individual mines also will be found scattered through the long chapter devoted to detailed mine descriptions.

The foregoing matter in this chapter is intended merely as an outline, and is not put forth as infallible in any particular, being merely the best judgment of the author, deduced from such limited studies of ore deposits as he has been able to make personally, amplified by the more detailed and valuable studies of many better authorities. For those who wish to make more careful investigation into the subject of ore deposits, and the geology of copper, I would recommend the perusal of Weed's Copper Mines of the World. While not holding with Mr. Weed on all points, the author of this brief monograph bears witness, cheerfully and gladly, to the vast amount of patient and well-considered investigation of details that has been made by Mr. Weed, and his exposition of the genesis and occurrence of copper ores, while by no means representing the last possible word in so wide a field, where so much remains to be learned, is much the most luminous and satisfactory of anything yet put forth in this particular line. The searcher after truth would do well also to read Kemp's Ore Deposits of the United States and Canada, and in this connection the monographs of Winchell, Lindgren and Sperr are worthy of the most serious consideration.

CHAPTER III.

Chemistry and Mineralogy of Copper.

In this chapter is given a brief outline of pertinent facts regarding the chemistry and mineralogy of copper, ending with an alphabetical list of copper minerals, which will be found to include a considerable number not mentioned in any other work. Despite the appreciable length of this chapter, no attempt has been made to render it exhaustive, as such an effort would, of necessity, include a long treatise on general mineralogy, which not only would be out of place in a work of this nature, but which, even were the ability at command, has been done to such excellent purpose by two generations of scientists of one family that Dana's System of Mineralogy stands, as it long has stood, the world's authority in the special field of mineralogy. To the average reader this chapter will give sufficient detail, and may be found of some interest to all who are especially interested in copper, while those desiring to make a serious study of the subject are referred to Dana's monumental work.

The elements with which copper unites most readily are sulphur, oxygen, carbon, silicon, arsenic, antimony, bismuth and chlorine. Among the other metals, iron is the most common associate of copper. Many copper ores are more or less argentiferous, and sulphide copper ores frequently carry gold, though gold is not found in chemical combination with copper.

Following is a list of the 36 elements with which copper has been found chemically united in nature. Following the full name of each element is its chemical symbol and atomic weight, as now figured by the best authorities.

Element	Symbol	Atomic weight.	Element	Symbol	Atomic weight.
Aluminum	Al	27.	Nickel	Ni	58.6
Antimony	Sb	120.	Niobium	Nb	93.7
Arsenic	As	74.9	Nitrogen	N	14.
Barium	Ba	137.	Oxygen	O	16.
Bismuth	Bi	207.5	Phosphorus	P	31.
Calcium	Ca	39.9	Platinum	Pt	194.3
Carbon	C	12.	Potassium	K	39.
Chlorine	Cl	35.4	Selenium	Se	78.9
Chromium	Cr	52.5	Silicon	Si	28.
Cobalt	Co	58.7	Silver	Ag	107.7
Copper	Cu	63.2	Sodium	Na	23.
Hydrogen	H	1.	Sulphur	S	32.
Iodine	I	126.5	Tellurium	Te	125.
Iron	Fe	55.9	Tin	Sn	117.4
Lead	Pb	206.4	Tungsten	W	183.6
Magnesium	Mg	24.	Uranium	U	240.
Manganese	Mn	54.8	Vanadium	V	51.1
Mercury	Hg	199.8	Zinc	Zn	65.1
Molybdenum	Mo	96.			

The ores of copper (alone or with other metals) may be divided into the following groups:

antimonides	iodides	sulphoantimonates
antimonites	manganates	sulphoantimonites
arsenates	molybdates	sulphoarsenates
arsenides	niobates	sulphoarsenites
arsenites	nitrates	sulphates
arsenoantimonites	oxides	sulphides
arsenobismuthites	oxychlorides	sulphobismuthites
arsenophosphates	phosphates	tellurides
bismuthides	phosphochromates	tungstates
carbonates	selenides	uranates
chlorides	selenites	vanadates
chlorosulphates	silicates	

While the appended alphabetical list of copper minerals gives several hundred titles, the more important ores are scarcely more than a dozen in number, though many of the minor minerals are of local importance in certain fields.

The sulphide ores are of predominant importance. Of these chalcopyrite, the lowest in copper tenor, is the most common, being found in practically every copper field. The major production from sulphide ores comes, however, from the rich chalcocite or copper glance. Bornite, the first alteration product of chalcopyrite in the ascending scale of enriched sulphide ores, is a valuable ore, and is found in large quantities in many copper fields. Covellite, the next richest sulphide above bornite, is found in connection with bornite and chalcocite in most sulphide districts, but as a rule does not occur in large quantities, though by no means a rare ore, and in a few fields, as in Utah and Wyoming, is found in quantities of considerable commercial importance. There are numerous other copper sulphides and copper-iron sulphides that are found in greater or less profusion, but many of these greatly resemble the more important sulphides previously noted, and rarely are differentiated in practical mining operations. There are a number of copper sulphates, of which chalcanthite is the only important ore. While found in natural beds, in Chile, this mineral is, as a rule, essentially a joint product of man and nature, the mine openings in sulphide ores made by man being leached by nature. Being readily soluble, and the copper contents easily precipitated, considerable copper is secured, in many districts, by leaching mine waters charged with bluestone, and in Spain a large part of the extensive copper product is secured in this form.

Next in commercial importance after the sulphide ores comes native copper. This is mined very extensively in the Lake Superior district, and on a considerable scale in Bolivia. Native copper is found in the upper workings of most rich mines of copper ore, and the aggregate production therefrom is quite large.

Third in importance come the carbonates. Of these, azurite and malachite are the only ones usually found in considerable quantities, and malachite is of much the greater importance. This ore is found in profusion in the upper or oxidized workings of many mines, and being rich and easily smelted, is the source of a considerable share of the world's copper supply.

The copper oxides usually are found in connection with the carbonates, and are mined and smelted therewith, being rich and easily reduced. Cuprite is the richest of all copper ores, but melaconite is far more common.

The only important commercial ore among the copper silicates is chrysocolla. This occurs frequently, and in considerable quantities, with the oxidized ores of many mines, and also is found disseminated in low-grade ore bodies at many points. It is probable that a larger proportion of copper will be secured, eventually, from silicate ores, perhaps by leaching processes.

The arsenical ores are common, but as a rule are present in just sufficent quantities to interfere with smelting. In Butte, Montana, enargite is a highly important copper ore, and is handled with signal success. In Chile and Perû arsenical ores are found in large quantities. Tetrahedrite, which shades by almost imperceptible gradations into tennantite, is a fairly common ore, but is not regarded with favor by miners, unless carrying considerable quantities of silver, which frequently is the case, the presence of both arsenic and antimony, frequently with bismuth added, rendering it difficult of smelting. Formerly the metal produced from gray copper ores was so poisoned with arsenic, antimony and bismuth, all deleterious elements, that such copper was suitable for only the roughest and cheapest of uses to which the metal could be put, but the general adoption of the electrolytic refining process has provided a way for eliminating these undesirable elements from the copper produced from gray ores.

In Chile considerable copper is secured from chloride ores, mainly atacamite.

An alphabetical list of copper minerals, including native copper and synonyms, is appended.

ACICULITE. Aikinite.

ADAMITE. A hydrous basic zinc arsenate, in which copper sometimes replaces zinc to the extent of circa 18%.

AGUILARITE. An unnamed alternation product of aguilarite has the formula $5(Ag,Cu)_2S.(Sb,As)_2S_3$. The mineral, which is a arsenosulphoantimonite is isometric.

AIKINITE. $3(Pb,Cu_2)S.Bi_2S_3$. A lead and copper sulphobismuthite, carrying 11% copper. Common names needle ore, acicular bismuth. Crystallization, orthorhombic. Fracture, uneven. Hardness, 2 to 2.5. Gravity, 6.1 to 6.8. Lustre, metallic. Color, blackish lead-gray, tarnishing to pale copper-red. Fuses on charcoal and is soluble in nitric acid. Occurrence, Ural Mountains of Russia and Gold Hill, North Carolina.

ALASKAITE. An argentiferous and cupriferous variety of galenobismutite, which is a lead sulphobismuthite, carrying 3.5 to 5.1% copper.

ADGODONITE. Cu_3As. A copper arsenide carrying 85.5% copper. Structure, massive and granular. Fracture, subconchoidal. Hardness, 4. Gravity, 7.62. Lustre, metallic on fresh fractures, dulling on exposures. Color, steel-gray to silver-white on freshly polished surface. Is less fusible than domeykite. Occurs in Chile and Lake Superior, in the latter district being found in cross-courses traversing the cupriferous beds of the South Range mines, causing the copper product to be highly arsenical.

ALISONITE. $3Cu_2S.PbS$. A copper and lead sulphide, carrying 53.5% copper, and 28.5% lead. Is related to cuproplumbite. Structure, massive. Color, deep indigo-blue, quickly tarnishing. Occurs at Coquimbo, Chile.

AMMIOLITE. Formula undetermined. A mercury and copper antimonite, carrying circa 12.5% copper. Occurs, as an earthy powder, in Chile.

ANDREWSITE. Formula undetermined. A hydrous iron and copper phosphate related to chalcosiderite, containing circa 8.6% copper.

ANNIVITE. A bismuthiferous variety of tennantite, from Switzerland.

ANTIMONIAL COPPER. Common name for chalcostibite.

ANTLERITE. Formula probably $10CuO.3SO_3.7H_2O$. A basic copper sulphate, containing circa 54.7% copper. Structure, massive. Gravity, 3.93. Color, light green. From Yucca, Mohave county, Arizona.

APHANESITE. Clinoclasite.

APHTONITE. An argentiferous and zinciferous variety of tetrahedrite.

ARNIMITE. $5CuO.2SO_3.6H_2O$. A hydrous basic copper sulphate, containing 47.6% copper. Occurs in acicular crystals.

ARSENICAL COPPER. Domeykite.

ASPEROLITE. $CuSiO_3+3H_2O$. A hydrous copper silicate. Apparently a hydrated chrysocolla, from Tagilsk, Perm, Russia.

ATACAMITE. $CuCl_2.3Cu(OH)_2$. A hydrous copper oxychloride, containing 60.5% copper. Crystallization, orthorhombic. Fracture, conchoidal. Tenacity, brittle. Hardness, 3 to 3.5. Gravity, 3.75. Lustre, adamantine to vitreous. Color, emerald green to blackish green. Streak, apple-green. Is transparent to translucent. Occurs, as sandy granules, in numerous mines in the province of Atacama, Chile, and elsewhere. Usually occurs disseminated, and low in copper tenor, but is extensively mined in Chile.

ATELITE. $2CuO.CuCl_2.3H_2O$. A hydrated copper oxychloride. An alteration product from Mt. Vesuvius, closely related to atacamite chemically and mineralogically, but occurring as a pseudomorph after tenorite.

ATLASITE. A copper carbonate containing chlorine, from Chañarcillo, Chile. Apparently is merely an intimate mixture of azurite and atacamite.

AURICHALCITE. $2(Zn,Cu)CO_3.(Zn,Cu)(OH)_2$. A basic zinc and copper carbonate, containing 16.6% copper. Crystallization, probably monoclinic. Occurs in acicular crystals, forming drusy incrustations, also columnar, laminated and granular. Hardness, 2. Gravity, 3.5 to 3.6. Lustre, pearly. Color, pale green to sky-blue. Streak, light green to light blue. Is translucent. Is soluble in acids. Occurs in small quantities in many zinc and copper fields.

AZURITE. $2CuO.2CO_2.H_2O$. A basic, copper carbonate, containing 55.3% copper. Common names, blue carbonate of copper, blue malachite, azure copper ore. Crystallization, monoclinic. Fracture, conchoidal. Tenacity, brittle. Hardness, 3.5 to 4. Gravity, 3.77 to 3.83. Lustre, vitreous. Color, azure blue. Streak, lighter blue. Is subtranslucent to transparent. Is soluble in nitric acid. Occurs frequently in the oxidized zone of copper ore bodies, almost invariably with malachite, but is much less common than malachite. Is a valuable commercial ore of copper.

BARNHARDTITE. Formula uncertain. A copper and iron sulphide, probably an alteration product from chalcopyrite that has lost part of its iron and copper, containing 46.7 to 50.4% copper. Apparently is nearer to bornite than to chalcopyrite. Structure, massive, compact. Fracture, conchoidal. Hardness, 3.5. Gravity, 4.5. Lustre, metallic. Color, bronze-yellow, tarnishing to pinchbeck-brown. Streak, grayish black, slightly shining. Occurrences, North Carolina and Arizona.

BARRACANITE. Cupropyrite.

BAYLDONITE. $4(Pb,Cu)O.As_2O_5.2H_2O$. A hydrous basic lead and copper arsenate containing 26.1% copper. Occurs in minute mamillary concretions with drusy surface. Fracture, subconchoidal. Hardness, 4.5. Gravity, 5.35. Lustre, resinous. Color, grass-green to blackish green. Streak, apple-green. Is subtranslucent. Soluble, with difficulty, in nitric acid. Occurs in Cornwall, England.

BEAUMONTITE. A very doubtful hydrous copper silicate, from Chessy, France.

BELL-METAL ORE. Common name for stannite.

BERZELIANITE. Cu_2Se. A copper selenide containing 61.6% copper. Occurs disseminated in incrustations. Is very soft. Gravity, 6.71. Lustre, metallic. Color, silver-white, soon tarnishing. Streak, shining. Usually is argentiferous. Occurs in Småland, Sweden.

BEUDANTITE. Apparently this name is applied to two minerals, one an arsenate and the other a sulphate of iron, lead and copper, carrying from a trace to 9.8% copper.

BINNITE. Formula probably $3Cu_2S.2As_2S_3$. A copper sulphoarsenite, containing 37.7% copper. Crystallization, isometric. Fracture, conchoidal. Tenacity, brittle. Hardness, 2.5 to 3. Gravity, 4.47. Lustre, metallic. Color, dark steel-gray to iron-black. Streak, reddish brown. Occurrence, Binnenthal, Switzerland.

BLACK COPPER. Common name for melaconite or disseminated chalcocite. In all likelihood much of what has been taken for melaconite in the past was disseminated chalcocite.

BLUE COPPER. Common name for azurite.

BLUE MALACHITE. Common name for azurite

BLUESTONE. Common name for chalcanthite; also for blue vitriol, the manufactured product corresponding in chemical formula with chalcanthite.

BLUE VITRIOL. Common name for chalcanthite or bluestone.

BOGOSLOVSKITE. Chrysocolla carrying carbon dioxide as an impurity, from the Bogoslovsk mine, Perm, Russia.

BOLEITE. $(Pb,Cu,Ag)Cl_2OH_2$. A hydrated lead, copper and silver oxychloride, containing circa 12% copper. Crystallization, isometric. Hardness, 3 to 3.25. Gravity, 5.08. Color, indigo-blue. Occurrence, at the Boleo mines, Baja California, Mexico.

BORNITE. Cu_5FeS_4. A copper and iron sulphide, containing 55.5% copper, 16.4% iron, 28.1% sulphur. Common name, peacock copper ore. Crystallization, isometric, with many hexagonal penetration twins. Struc-

ture, granular or compact. Fracture, small conchoidal to uneven. Tenacity, brittle. Hardness, 3. Gravity, 4.9 to 5.4. Lustre, metallic. Color, copper red to bluish brown, quickly tarnishing to iridescence, often most brilliant. Streak, pale grayish-black. Is soluble in nitric acid, with separation of sulphur. Is the first alteration product from chalcopyrite among the secondary copper sulphides, and often carries nodules and occasionally larger masses of chalcocite. Is one of the most important ores of copper.

BOTALLACKITE. Atacamite.

BOURNONITE. $3(Pb,Cu_2)S.Sb_2S_3$. A lead and copper sulphoantimonite, containing 13% copper, and 42.5% lead. Crystallization, orthorhombic. Structure, massive, granular and compact. Cleavage, imperfect. Fracture, subconchoidal to uneven. Tenacity, rather brittle. Hardness, 2.5 to 3. Gravity, 5.7 to 5.9. Lustre, brilliant metallic. Color and streak, steel-gray, inclining to blackish-gray or iron-black. Fuses easily on charcoal and is soluble in acids. Occurrence, in many copper fields.

BRASS ORE. Common name for aurichalcite.

BROCHANTITE. $4CuO.SO_4.3H_2O$. A basic copper sulphate containing 56.2% copper. Crystallization, orthorhombic. Fracture, uneven. Hardness, 3.5 to 4. Gravity, 3.9. Lustre, vitreous. Color, emerald-green to blackish green. Streak, paler green. Is translucent to transparent. Is found in many copper fields, and is an important commercial ore in the Clifton district, Graham county, Arizona.

BURATITE. An aurichalcite containing calcium monoxide, probably as a mechanical admixture.

CACHEUTAITE. A lead, copper and silver selenide carrying 7 to 36% copper. Is closely related to zorgite.

CALCIOVOLBORTHITE. $4(Cu,Ca)O.V_2O_5.H_2O$. A hydrous basic copper and calcium vanadate, containing 31.7% copper. Hardness, 3.5. Gravity, 3.5 to 3.86. Color, gray to green. Streak, brownish yellow to greenish yellow. Occurrence, Thuringia, Germany.

CALEDONITE. $2(Pb,Cu)O.SO_3.H_2O$. A basic lead and copper sulphate, containing 9.4% copper. Crystallization, orthorhombic. Fracture, uneven. Tenacity, rather brittle. Hardness, 2.5 to 3. Gravity, 6.4. Lustre, resinous. Color, verdigris-green to bluish green. Streak, greenish white. Is translucent. Occurrence, Scotland, Hungary, California, etc.

CANTONITE. A dimorphous variety of covellite, apparently a pseudomorph after galena, crystallized in cubes with cubical cleavage.

CAPILLARY RED OXIDE OF COPPER. Common name for cuprite.

CARMENTITE. A variety of digenite.

CARROLLITE. $CuS.Co_2S_3$. A cobalt and copper sulphide containing 20.5% copper and 38% cobalt. Crystallization, isometric. Fracture, subconchoidal to uneven. Hardness, 5.5. Gravity, 4.85. Lustre, metallic. Color, light steel-gray, with faint reddish hue. Occurrence, Carroll county, Georgia.

CASTILLITE. $(Cu,Ag)_2S.2(Cu,Pb,Zn,Fe)S$. A copper, silver, lead, zinc and iron sulphide carrying circa 41% copper. Apparently an impure bornite. Structure, massive. Hardness, 3. Gravity, 5.19 to 5.24. Resembles bornite in color, streak and tarnish. Occurrence, Guanacevi, Mexico.

CHALCANTHITE. $CuSO_4+5H_2O$. A hydrous copper sulphate containing 25.4% copper. Common names, blue vitriol, bluestone, copper sulphate. Crystallization, triclinic. Structure, massive, stalactitic and reniform, sometimes fibrous. Fracture, conchoidal. Tenacity, brittle. Hardness, 2.5. Gravity, 2.12 to 2.30. Lustre, vitreous. Color, sky-blue. Streak, uncolored. Is translucent to subtransparent. Is soluble in water. Occurs as deposits from mine water in most sulphide copper mines, and is found in impure state, in beds, in Chile.

CHALCOCITE. Cu_2S. A copper sulphide carrying 79.8% copper. Common names, copper glance, cuprous sulphide. Crystallization, orthorhombic; also occurs massive, with structure granular to compact and impalpable. Cleavage, indistinct. Fracture, conchoidal. Tenacity, brittle. Hardness, 2.5 to 3. Gravity, 5.5 to 5.8. Lustre, metallic. Color and streak, blackish lead-gray, tarnishing to dull green or blue. Is soluble in nitric acid. Occurs in all copper districts, frequently in large quantities. Is the richest commercial ore of copper and yields more than one-half of the world's copper supply.

CHALCOLITE. Torbernite.

CHALCOMENITE. $CuO.SeO_2.2H_2O$. A hydrous copper selenite containing 28% copper. Crystallization, monoclinic. Gravity, 3.76. Lustre, vitreous. Color, bright blue. Is transparent. Is soluble in acids. Found at Cacheuta, Mendoza, Argentina.

CHALCOMICHLITE. Bornite.

CHALCOPHACITE. Liroconite.

CHALCOPHYLLITE. $7CuO.As_2O_5.4H_2O$. A hydrous basic copper arsenate containing 42.3% copper. Crystallization, rhombohedral. Hardness, 2. Gravity, 2.43 to 2.66. Lustre, vitreous. Color, grass-green to verdigris-green. Streak, grass-green. Occurs in Hungary, Siberia and Utah.

CHALCOPYRITE. $Cu_2S.Fe_2S_3$. A copper and iron sulphide containing 34.5% copper and 30.5% iron. Is the primary ore of copper. Crystallization, tetragonal, sphenoidal, often twinning, also frequently massive and compact. Fracture, uneven. Hardness, 3.5 to 4. Gravity, 4.1 to 4.3. Lustre, metallic. Color, brass-yellow, often tarnishing to iridescence. Streak, greenish black. Is soluble, except sulphur, in nitric acid, and, on being heated, yields a portion of its sulphur. On exposure to moisture and heat becomes hydrated, and copper and iron change readily to sulphates. Alters to azurite, malachite, melaconite, chalcocite, covellite, bornite, brochantite, chrysocolla, tetrahedrite and tennantite. Is found in practically every copper field in the world, and is second only to chalcocite in importance among the commercial ores of copper.

CHALCOPYRRHOTITE. $CuS.Fe_4S_5$. An iron and copper sulphide containing 13% copper and 48.2% iron. Structure, massive. Hardness, 3.5 to 4. Gravity, 4.28. Color, brassy, with brownish tinge. Occurrence, Nya Kopparberg, Sweden.

CHALCOSIDERITE. $CuO.3Fe_2O_3.2P_2O_5.8H_2O$. A hydrous iron and copper phosphate containing 6.4% copper. Hardness, 4.5. Gravity, 3.1.

Lustre, vitreous. Color, light siskin-green. Streak; pale green. Occurs in Cornwall, England and Westphalia, Germany.

CHALCOSINE. Chalcocite.

CHALCOSTIBITE. $Cu_2S.Sb_2S$. A copper sulphoantimonite containing 25.6% copper and 48.5% antimony. Crystallization, orthorhombic. Fracture, subconchoidal. Tenacity, brittle. Hardness, 3 to 4. Gravity, 4.75 to 5. Lustre, metallic. Color, between lead-gray and iron-gray. Occurrence, in the Hartz Mountains of Germany and in Guadix, Spain.

CHALCOTRICHITE. A form of cuprite with capillary or acicular crystallization. Common name, plush copper ore.

CHELEUTITE. A ferruginous, nickeliferous and slightly cupriferous smaltite.

CHENEVIXITE. $2CuO.Fe_2O_3.As_2O_5.3H_2O$. A hydrous copper and iron arsenate containing 21% copper. Structure, massive. Fracture, subconchoidal. Hardness, 3.5 to 4.5. Gravity, 3.93. Lustre, vitreous. Color, dark olive-green to greenish yellow. Streak, yellowish green. Is soluble in acids. Occurrence, Cornwall, England and Eureka, Juab county, Utah.

CHESSY COPPER. Common name for azurite.

CHILEITE. Formula uncertain. A hydrous lead and copper vanadate containing 11.7 to 13.6% copper. Is related to psittacinite. Structure, earthy. Occurrence, Chile.

CHILENITE. $(Ag,Cu)_4Bi$. A silver and copper bismuthide containing 8.5% copper and 75% silver. Structure, amorphous, granular. Is soft. Color, silver-white. Occurrence, Copiapó, Chile.

CHIVIATITE. A lead sulphobismuthite carrying circa 2.5% copper.

CHLOANTHITE. Empirically nickel diarsenide, but analyses invariably show cobalt and iron, and commonly small quantities also of copper, lead, silver, bismuth and antimony.

CHLOROTHIONITE. $CuCl_2.K_2SO_4$. A copper and postassium chlorosulphate. Is an alteration product from Mt. Vesuvius.

CHLOROTILE. Formula probably $3CuO.As_2O_5+6H_2O$. A hydrous copper arsenate containing circa 33% copper. Is related to trichalcite. Crystallization, orthorhombic; also occurs fibrous and massive. Is soft. Color, pale emerald-green. Is transparent.

CHRYSOCOLLA. $CuSiO_3+2H_2O$. A hydrous copper silicate carrying 36% copper. Common names, mountain green and mountain blue. Structure, cryptocrystalline, enamel-like, sometimes botryoidal. Fracture, conchoidal. Is brittle and somewhat sectile. Hardness, 2 to 4. Gravity, 2 to 2.24. Lustre, vitreous to earthy. Color, mountain green, bluish green and sky blue to turquoise-blue, with impure varieties brown to dull black. Streak, white, from pure green and blue varieties. Is opaque to translucent. Is decomposed by acids, without gelatinization. Commonly occurs with carbonate ores in the oxidized zones of copper ore bodies, and is a commercial ore of value in many districts.

CLAYITE. A lead sulphoantimonite, carrying copper as a replacement of lead to extent of circa 8%.

CLINOCLASITE. $6CuO.As_2O_5.3H_2O$. A hydrous basic copper ar-

senate carrying 48% copper. Crystallization, monoclinic. Is brittle. Hardness, 2.5 to 3. Gravity, 4.19 to 4.36. Lustre, vitreous to resinous. Color, blackish blue-green externally, dark verdigris-green internally. Streak, bluish green. Is subtransparent to translucent. Is soluble in nitric acid. Occurrence, Cornwall and Utah.

COPPER. Cu. Native copper. The chemical symbol Cu is an abbreviation of cuprum, the Latin word for copper. The metal, native or refined, has the following names in modern languages: kupfer in German; koppar in Swedish; kobber in Norwegian; cobre in Spanish and Portuguese; cuivre in French; rame in Italian.

Atomic weight, 63.2. Belongs in the first group and is the leader of the fifth series of Mendeleéf's Periodic System. The group is as follows: 1, hydrogen; 2, lithium; 3, sodium; 4, potassium; 5, copper; 6, rubidium; 7, silver; 8, cæsium; 9, unknown (possibly terbium, atomic weight 160); 10, gold; 11, unknown. The fifth series, of which copper is the basic leader, is as follows: 1, copper; 2, zinc; 3, gallium; 4, germanium; 5, arsenic; 6, selenium; 7, bromine. The three metallic elements falling between series four and five in Mendeleéf's table, are iron, cobalt and nickel. The frequency with which these three elements are found associated with copper, and the ease with which all four metals replace one another, are notable. The general resemblance between copper, silver and gold, which form ascending steps in the same group, is readily apparent.

System of crystallization, isometric. Tetrahexahedronal forms are the most common, with much twinning. Crystals often show cavernous faces and occasionally elevations, are often distorted and pass gradually through distortions into filiform and arborescent forms. Native copper also occurs massive, in granular form, and in laminae. In the Lake Superior mines the metal occurs in all observed forms and sizes, including lamellae from microscopic flakes up to sheets of immense size and weight, crystals of greatly varying form and size, grains from microscopic size to considerable nodules, and druses, often of considerable size, show various filiform and arborescent shapes. The finest particles are grains and exceedingly minute flakes, occurring in an upper sandstone of the Keweenawan series, while the largest masses, weighing upwards of 500 tons, have been found in contact and fissure veins.

Cleavage, none. Fracture, hackly. Tenacity, second only to that of iron. Is perfectly sectile and highly ductile and malleable, ranking in these particulars with the precious metals. Electrical conductivity, 931, as compared with 1,000 for silver, which possesses the most perfect electrical conductivity of any known metal or alloy. Conductivity for heat, 898, as compared with 1,000 for gold, the most perfect conductor of heat.

Hardness, 2.5 to 3. Specific gravity, in vacuo, at 0 degrees Centigrade (equal to 32°, or freezing point, Fahrenheit), when chemically pure and devoid of porosity, is 8.945. Specific gravity of the ordinary copper of commerce, none of which is free from impurities, varies from about 8.75 when cast, to about 8.95 when rolled, hammered or drawn, the exact gravity depending upon how handled, as well as upon the extent and nature of the impurities contained.

Lustre, metallic. Color, copper-red. Streak, copper-red, metallic, shin-

ing. Tarnishes upon exposure to air to brownish red, and is liable to form a coating of verdigris or oxide upon long exposure to air. Atmosphere laden with moisture and carbonic acid is especially favorable to the formation of verdigris.

Fusibility: Copper is fusible at approximately 2,000° Fahrenheit, or a trifle less than 1,100° Centigrade. Color, when fused, sea-green. Copper becomes volatile under the high temperature of the electric arc.

Solubility: Copper is soluble in nitric acid, aqua regia, and strong boiling sulphuric acid, also, slowly, in dilute hydrochloric and sulphuric acids, with admission of air. When in solution in nitric or sulphuric acids will deposit metallic copper on iron immersed therein.

Affinities: Copper has a greater affinity for sulphur than for any other element, possessing also marked affinities for oxygen, carbon dioxide, arsenic, antimony and bismuth, and unites with many other elements.

Alterations: Native copper alters on exposure, especially in damp air, to the simpler oxide and carbonate ores, such as cuprite, malachite and azurite, and occasionally, in time, to the more complex ore forms.

Occurrence: Native copper occurs, usually in small quantities, in most of the principal copper districts of the world. The native metal is mined upon a considerable scale only in Lake Superior, U. S. A., and Bolivia. The Lake Superior native copper carries considerable silver, mechanically admixed, though not alloyed, but carries no gold. In districts outside of Lake Superior and Bolivia the metal occurs most frequently in connection with the oxide and carbonate ores, and occasionally with the secondary sulphide ores.

Impurities: Native copper frequently contains silver, arsenic, bismuth, antimony, zinc and occasionally mercury. Commercial copper, refined from ores, may contain any of the elements already named, and also gold, tin, lead, selenium and tellurium, the latter two elements in very minute quantities.

COPPER GLANCE. Common name for chalcocite.

COPPER MICA. Common name for chalcopyrite.

COPPER NICKEL. Common name for niccolite.

COPPER PHOSPHATE. Common name for libethenite.

COPPER PITCHBLENDE. An impure chrysocolla containing limonite.

COPPER PYRITES. Common name for chalcopyrite.

COPPER SULPHATE. Common name for chalcanthite in nature; bluestone when manufactured.

COPPER URANITE. Common name for torbernite.

COPPER VITRIOL. Common name for chalcanthite when found native, or for bluestone when manufactured.

COPPITE. A ferruginous variety of tennantite.

CONDURRITE. Apparently a copper arsenide, related to domeykite. Is supposed to be an alteration product of tennantite. Is soft and black. Occurs in the Condurrow mine, and at Carn Brea, Cornwall, England.

CONICHALCITE. $4(Cu,Ca)O.\ As_2O_5.\ 1\frac{1}{2}H_2O$. A hydrous basic copper and calcium arsenate, carrying 24% copper. Structure, reniform and mas-

ve. Fracture, splintery. Tenacity, brit-
olor and streak, pistachio-green. Is subtranslucent.
Spain and at Eureka, Juab county, Utah.

CONNELLITE. Formula probably $Cu_{18}(Cl,OH)_4SO_{16}.15H_2O$. A hydrous basic copper chlorosulphate, containing circa 57.6% copper. Crystallization, hexagonal. Hardness, 3. Gravity, 3.36. Lustre, vitreous. Color, fine blue. Is translucent. Is soluble in nitric acid. Occurrence, Cornwall, England.

CORNWALLITE. $5CuO.As_2O_5.3H_2O$. A hydrous basic copper arsenate containing 46.5% copper. Structure, massive. Fracture, conchoidal. Hardness, 4.5. Gravity, 4.16. Color, verdigris-green to emerald green. Occurrence, Cornwall, England.

COSALITE. Empirically lead sulphobismuthite, but usually cupriferous to the extent of from a trace to 8.75% copper.

COVELLINE. Covellite.

COVELLITE. CuS. A copper sulphide containing 66.4% copper. Chemical name, cupric sulphide. Crystallization, hexagonal; also occurs massive. Is flexible in thin layers, with basal cleavage. Hardness, 1.5 to 2. Gravity, 4.6. Lustre, submetallic on crystals, dull when massive. Color, dark indigo-blue. Streak, lead-gray to black, shining. Occurs in most sulphide copper districts, as a secondary ore and is a valuable commercial ore of copper, when found in sufficient quantities, as in Utah, Wyoming and elsewhere.

CLARITE. A dimorphous form of enargite, from Schapbach, Baden, Germany.

CREDNERITE. $3CuO.2Mn_2O_3$. A copper manganate containing 34–4 % copper. Crystallization, monoclinic. Cleavage, basal, perfect, less distinct in other directions. Hardness, 4.5. Gravity, 4.9 to 5.1. Lustre, metallic. Color, iron-black to steel-gray. Streak, brownish black. Is soluble in hydrochloric acid.

CROOKESITE. $(Cu,Tl,Ag)_2Se$. A copper, thallium and silver selenide, containing 44 to 46% copper, 17 to 18.5% thallium and 1.5 to 5% silver. Structure is massive, without crystallization. Is brittle. Hardness, 2.5 to 3. Gravity, 6.9. Lustre, metallic. Color, lead-gray. Occurrence, Skrikerum, Sweden.

CUBANITE. CuS. Fe_2S_3. An iron and copper sulphide containing 23.3% copper and 41.3% iron. Crystallization, isometric; also occurs massive. Cleavage, cubic. Hardness, 4. Gravity, 4.026 to 4.169. Color, bronze to brass-yellow. Streak, dark reddish bronze to black. Occurrence, Cuba and Sweden.

CUMENGITE. $PbCl_2.CuO.H_2O$. A hydrous lead and copper oxychloride, related to boléite. Crystallization, tetragonal.

CUPRIC OXIDE. Tenorite, when found in nature; copper monoxide in chemistry.

CUPRITE. Cu_2O. A copper oxide, containing 88.8% copper, being the Chemical names, cuprous oxide, copper protoxide. Com-
-lassy copper ore, octrahedral copper ore.

granular and sometimes earthy. Fracture, conchoidal. Is brittle. Hardness, 3.5 to 4. Gravity, 5.85 to 6.15. Lustre, adamantine to earthy. Color, light to dark red; when fresh, usually ruby-red, but fades to duller red. Streak, brownish red, shining. Is subtransparent to subtranslucent. Occurs in most copper districts in the upper oxidized zone, frequently shading into crystals of native copper.

CUPROBISMUTITE. $3Cu_2S.\ 4Bi_2S_3$. A copper sulphobismuthite containing 15% copper and 65.1% bismuth. Occurs in prismatic crystals. Gravity, 6.31 to 6.68. Lustre, metallic. Color, dark bluish black. Streak, black. The copper frequently is replaced partially by silver.

CUPROCALCITE. Formula perhaps $(Cu_2O)_2.\ CO_2+2CaO.\ CO_2+H_2O$. Apparently merely an intimate mixture of cuprite and calcium carbonate. Hardness, 3. Gravity, 3.9. Color, vermilion-red. Is soluble in hydrochloric acid.

CUPROCASSITERITE. Formula possibly $4SnO_2+Cu_2Sn(OH)_2$. Occurrence, Black Hills of South Dakota.

CUPRODESCLOIZITE. A cupriferous variety of descloizite, which is a basic lead and zinc vanadate.

CUPROFERRITE. Pisanite.

CUPROIODARGYRITE. CuI.AgI. A copper and silver iodide. Apparently a decomposition product of stromeyerite. Occurs, as incrustations, at Huantajaya, Chile.

CUPROMAGNESITE. $(Cu, Mg)\ SO_4+7H_2O$. A copper and magnesium sulphate. Color, bluish green. Is an alteration product, occurring as incrustations, from Mt. Vesuvius.

CUPROPLUMBITE. $5Cu_2S.\ PbS$. A copper and lead sulphide, carrying 61.3% copper and 19% lead. Structure, massive. Lustre, feeble or lacking. Color, lead-gray to indigo-blue. Occurence, Catemou, Aconcagua, Chile, Butte, Montana, and Semipalatinsk, Siberia.

CUPROPYRITE. $CuFe_2S_4$. An iron and copper sulphide, carrying 24% copper. Is closely related to cubanite.

CUPROSCHEELITE. $(Ca,Cu)WO_4$. A calcium and copper tungstate carrying 3 to 5% copper. Is a variety of cuprotungstite in which copper is mainly replaced by calcium.

CUPROTUNGSTITE. $CuWO_4$ A copper tungstate carrying 24% copper. Structure, granular and incrustive. Hardness, 4.5 to 5. Color, pistachio-green to leek-green. Streak, greenish gray to greenish yellow. Is soluble in hydrochloric acid. Occurrence, Llamuco, Santiago de Chile.

CUPROURANITE. Torbernite.

CUPROUS OXIDE. Cuprite in nature. Chemical term for two atoms of copper united with one atom of oxygen.

CUPROVANADITE. Chileite.

CYANOCHALCITE. A phosphoriferous variety of chrysocolla, from Nijni Tagilsk, Perm, Russia.

CYANOCHROITE. $CuSO_4.K_2SO_4+6H_2O$. A hydrous copper and potassium sulphate, carrying 14.3% copper. Crystallization, monoclinic. Color, clear blue. Is an alteration product from Mt. Vesuvius.

CYANOTRICHITE. $4CuO.Al_2O_3.SO_3.8H_2O$. A hydrous basic copper and aluminum sulphate, carrying 39.4% copper. Crystallization, orthorhombic. Lustre, pearly. Color, smalt-blue to sky-blue. Occurrence, Hungary, France, Arizona and Utah.

DARWINITE. Whitneyite.

DELAFOSSITE. An iron, copper and aluminum oxide containing 37.9% copper, 47.99% iron sesquioxide and 3.52% aluminum sesquioxide. Occurrence, Ekaterinburg, Perm, Russia.

DEMIDOVITE. A phosphoriferous variety of chrysocolla from Tagilsk, Perm, Russia.

DIGENITE. Apparently a partly altered chalcocite containing a considerable percentage of covellite.

DIHYRITE. $5CuO.P_2O_5.2H_2O$. A hydrous basic copper phosphate containing 55.2% copper. Crystallization, monoclinic; also occurs massive and fibrous. Fracture, conchoidal to uneven. Tenacity, brittle. Hardness, 4.5 to 5. Gravity, 4 to 4.4. Lustre, adamantine. Color, dark emerald-green. Streak, pale emerald-green. Is translucent. Is soluble in nitric acid. Occurrence, Germany and the Ural Mountains of Russia.

DILLENBURGITE. An impure chrysocolla containing copper carbonate.

DIOPTASE. $CuO.SiO_2.H_2O$. A hydrous copper silicate carrying 40.3% copper. Common names, emerald copper, emerald malachite. Crystallization, rhombohedral; also occurs massive. Fracture, conchoidal to uneven. Tenacity, brittle. Hardness, 5. Gravity, 3.28 to 3.35. Lustre, vitreous, Color, emerald-green. Streak, green. Is subtranslucent to transparent. Gelatinizes with hydrochloric acid. Is fusible with charcoal and soda. Occurrence, Chile, Hungary, Siberia, French Congo, Arizona, etc.

DOGNACSKAITE. Formula perhaps $3Cu_2.5Bi_2S_3$. A variety of cuprobismutite carrying slightly less copper and sulphur and slightly more bismuth than the normal mineral.

DOLEROPHANITE. $2CuO.SO_3$. A basic copper sulphate carrying 53.1% copper. Crystallization, monoclinic. Color, brown. Is soluble in nitric acid. Is a sublimation product from Mt. Vesuvius.

DOMEYKITE. Cu_3As. A copper arsenide carrying 71.7% copper. Common name, arsenical copper. Structure, reniform and botryoidal, also massive and disseminated. Fracture, uneven. Hardness, 3 to 3.5. Gravity, 7.2 to 7.75. Lustre, metallic, dulling on exposure. Color, tin-white to steel gray, tarnishing to iridescence. Is fusible in open tube, yielding a white sublimate of arsenic trioxide. Is soluble in nitric acid. Occurrence, Chile, Bolivia, Saxony, Mexico and Lake Superior.

DUCKTOWNITE. Apparently merely a mechanical mixture of chalcocite and pyrite.

DÜRFELDTITE. $3(Pb,Ag,Cu,Mn,Fe)S.Sb_2S_3$. A lead, silver, copper, manganese and iron sulphobismuthite. Occures in acicular crystals. Hardness, 2.5. Gravity, 5.4. Lustre, metallic. Color light gray. Is related to stylotypite. Found in Perū.

EHLITE. $5CuO.P_2O_5.3H_2O$. A hydrous basic copper phosphate con-

taining 52 to 55% copper. Is closely related to dihydrite and pseudomalachite. Gravity, 4.2 to 4.4. Occurrence, Cornwall, England and Nijni Tagilsk, Perm, Russia.

EMERALD COPPER. Common name for dioptase.

EMERALD MALACHITE. Common name for dioptase.

EMPLECTITE. $Cu_2S.Bi_2S_3$. A copper sulphobismuthite containing 18.9% copper and 62% bismuth. Crystallization, orthorhombic. Tenacity, brittle. Hardness, 2. Gravity, 6.3 to 6.5. Lustre, metallic. Color, tin-white. Occurrence, Chile, Saxony and Norway.

ENARGITE. $3Cu_2.As_2S_5$. A copper sulphoarsenite containing 48.3% copper. Crystallization, orthorhombic; also occurs massive and granular. Fracture, uneven. Tenacity, brittle. Hardness, 3. Gravity, 4.45. Lustre, metallic. Color and streak, grayish black to iron-black. Is soluble in aqua regia and fusible on charcoal. Occurs in many copper fields, notably at Butte, Montana, where it is a common and valuable ore.

EPIGENITE. Formula probably $4Cu_2S.3FeS.As_2S_5$. A copper and iron sulphoarsenite, carrying circa 41% copper. Crystallization, orthorhombic. Fracture, uneven. Hardness, 3.5. Lustre, metallic. Color, steel-gray. Streak, black. Is soluble in nitric acid. Occurrence, Wittichen, Baden, Germany.

ERINITE. $5CuO.As_2O_5.2H_2O$. A hydrous basic copper arsenate, containing 47.8% copper. Occurs in mamillated concentric crystalline groups, also fibrous and rough. Tenacity, brittle. Hardness, 4.5 to 5. Gravity, 4.04. Lustre, slightly resinous. Color, emerald-green. Streak, grass-green. Is opaque to subtranslucent. Is soluble in nitric acid. Occurrence, Cornwall and Utah.

ERYTHROCALCITE. $CuCl_2+nH_2O$. A hydrated copper chloride. Is an alteration product from Mt. Vesuvius.

EUCAIRITE. $Cu_2Se.Ag_2Se$. A silver and copper selenide carrying 25.3% copper and 43.1% silver. Crystallization, isometric; also occurs massive and granular. Hardness, 2.5. Gravity, 7.5. Lustre, metallic. Color, silver-white to lead-gray. Streak, shining. Occurrence, Småland, Sweden, and Copiapó, Chile.

EUCHLORINE. A compound of copper sulphate and cuprous chloride, from Mt. Vesuvius.

EUCHROITE. $4CuO.As_2O_5.7H_2O$. A hydrous basic copper arsenate containing 39.7% copper. Crystallization, orthorhombic. Fracture, subconchoidal. Tenacity, brittle. Hardness, 3.5 to 4. Gravity, 3.39. Lustre, vitreous. Color, emerald-green to leek-green. Is translucent to transparent. Occurrence, Libethen, Hungary.

FAHLORE. Common name for tetrahedrite or tennantite.

FALKENHAYNITE. $3Cu_2S.Sb_2S_3$. A copper sulphoantimonite carrying 39.5% copper. Apparently is related to stylotypite. Structure, massive. Gravity, 4.83. Color, gray-black. Occurrence, Joachimsthal, Bohemia, Austria.

FAMATINITE. $3Cu_2S.Sb_2S_5$. A copper sulphoantimonite carrying 43.3% copper. Crystallization, orthorhombic; is isomorphous with enargite;

also occurs massive. Fracture, uneven. Tenacity, brittle. Hardness, 3.5. Gravity, 4.57. Color, gray with copper-red tinge. Streak, black. Is fusible on charcoal. Decrepitates in closed tube. Occurrence, Sierra de Famatina, Rioja, Argentina and Cerro de Pasco, Junín, Perú.

FIELDITE. A zinciferous variety of tetrahedrite.

FOOTEITE. $8Cu(OH)_2$. $CuCl_2+4H_2O$. A hydrous basic copper oxychloride containing 55.3% copper. Is closely related to tallingite. Crystallization, monoclinic. Color, deep blue. Occurrence, Bisbee, Arizona.

FOURNETITE. Apparently merely a mechanical mixture of tetrahedrite and galena.

FREDRICITE. An argentiferous, plumbiferous and stanniferous variety of tennantite, from Sweden.

FREIBERGITE. An argentiferous tetrahedrite carrying variable percentages of silver as a replacement of the copper found in the normal tetrahedrite.

FRIGIDITE. A ferruginous and nickleiferous variety of tennantite.

GERHARDITE. $4CuO.\ N_2O_5.\ 3H_2O$. A basic copper nitrate containing 52.9% copper. Crystallization, orthorhombic. Cleavage, yields flexible laminae. Tenacity, fragile and sectile. Hardness, 2. Gravity, 3.426. Lustre, vitreous, brilliant. Color, deep emerald-green. Streak, light green. Is transparent. Is soluble in dilute acids. Occurrence, Jerome, Arizona.

GERSDORFFITE. Empirically nickel sulphoarsenite, but occasionally slightly cupriferous.

GLANCE. Common name for sulphide ores with dark metallic lustre. Copper glance is chalcocite.

GLASBACHITE. Zorgite.*

GLAUCOPYRITE. An iron and cobalt diarsenide, occasionally slightly cupriferous.

GRAY COPPER. Common name for tetrahedrite; name also is applied to tennantite, which shades into tetrahedrite.

GREEN COPPER. Common name for malachite.

GRÜNAUITE. An impure nickel sulphide (polydimite) carrying copper, lead, cobalt, iron and bismuth, copper ranging 1.68 to 11.56% in tenor in published assays.

GUEJARITE. $Cu_2S.\ 2Sb_2S_3$. A copper sulphoantimonite containing 15.2% copper. Crystallization, orthorhombic. Tenacity, brittle. Hardness, 3.5. Gravity, 5.03. Lustre, metallic. Color, steel-gray, with bluish tinge. Streak, black. Occurrence, Andalusia, Spain.

HARRISITE. A pseudomorph of chalcocite after galena.

HENWOODITE. Chemical formula uncertain. A hydrous aluminum and copper phosphate carrying circa 5.6% copper. Occurs in botryoidal globular masses. Fracture, conchoidal. Hardness, 4.4 to 4.5. Gravity, 2.67. Color, turquoise-blue. Streak, bluish to greenish white. Occurs in Cornwall, England.

HERMESITE. An imperfectly established variety of schwatzite.

HERRENGRUNDITE. $CaO.\ 4CuO.\ 2SO_3.\ 6H_2O$. A hydrous basic cop-

per and calcium sulphate carrying 39.5% copper. Is related to brochantite. Crystallization, monoclinic. Tenacity, rather brittle. Hardness, 2.5. Gravity, 3.13. Lustre, vitreous. Color, emerald-green to bluish-green. Streak, light green. Is transparent. Occurrence, Herrengrund, Hungary.

HOMICHLINITE. Chemical formula uncertain. A copper and iron sulphide carrying circa 43.8% copper. Apparently is chalcopyrite partly altered to bornite, and close to barnhardtite. Crystallization, tetragonal; also occurs massive. Hardness, 4 to 5. Gravity, 4.48. Color, brassy bronze. Streak, black. Occurrence, Chile, Germany, Japan, etc.

HORSEFLESH ORE. Common name for bornite.

HORSFORDITE. Cu_5Sb. A copper antimonide carrying 76% copper. Structure, massive. Is brittle. Hardness, 4 to 5. Gravity, 8.8. Lustre, metallic. Color, silver-white, tarnishing easily. Is said to occur in large deposits on the Island of Mitylene, Asia Minor.

HYDROCIANITE. $CuO.SO_3$. A copper sulphate carrying 39.6% copper. Crystallization, orthorhombic. Is soluble in water. Is an alteration product from Mt. Vesuvius.

HYDROCUPRITE. Apparently a hydrated cuprite. Is amorphous, occurring in very thin coatings on magnetite. Color, orange-red to orange-yellow. Found at Schapbach, Baden, Germany, and at Cornwall, Pennsylvania.

INDIGO COPPER. Common name for covellite.

ISOPYRE. Apparently an impure opal, carrying about 1.6% copper, found at St. Just, Cornwall, England.

JALPAITE. $3Ag_2S.Cu_2S$. A silver and copper sulphide, carrying 13.1% copper and 71.5% silver. Apparently is a cupriferous argentite. Crystallization, isometric. Tenacity, malleable. Gravity, 6.89. Color, blackish lead-gray. Occurrence, Jalpa, Mexico.

JAMESONITE. A lead sulphoantimonite, sometimes cupriferous to the extent of about 3.5%.

JOHANNITE. Chemical formula uncertain. A hydrous uranium and copper sulphate, containing circa 4.8% copper. Crystallization, monoclinic. Hardness, 2 to 2.5. Gravity, 3.19. Lustre, vitreous. Color, emerald-green to apple-green. Streak, paler green. Is translucent to transparent. Taste, bitter. From Joachimsthal, Bohemia.

JULIANITE. A slightly argentiferous and ferruginous variety of tennantite, from Silesia, Germany.

KAMAREZITE. $(CuOH)_2SO_4.Cu(OH)_2+6H_2O$. A hydrated copper sulphate. Crystallization, probably orthorhombic. Occurrence, Laurium, Greece.

KARAMSINITE. Chemical formula uncertain. As determined is a weird silicate of aluminum, iron, manganese, copper, calcium, magnesium and potassium, containing circa 1.85% copper. Occurrence, Finland.

KEWEENAWITE. $(Cu,Ni)_2As$. A copper and nickel arsenide, related to mohawkite, carrying 39 to 54% copper and 9.7% to 20% nickel, with cobalt replacing nickel to extent of about 0.9%. Structure, massive. Cleavage, subconchoidal. Fracture, uneven. Tenacity, slight. Hardness, 4. Gravity, 7.7. Lustre, metallic. Color, pale red, tarnishing to

darker red. Is soluble in nitric acid. Occurrence, Mohawk mine, Keweenaw county, Michigan.

KLAPROTHOLITE. $3Cu_2S.\ 2Bi_2S_3$. A copper sulphobismuthite containing 25.3% copper and 55.4% bismuth. Crystallization, orthorhombic. Fracture, uneven. Tenacity, brittle. Hardness, 2.5. Gravity, 4.6. Lustre, metallic. Color, steel-gray, tarnishing to iridescent brass-yellow. Occurrence, Baden, Germany.

KOBELLITE. A lead sulphoantimonite, usually cupriferous to the extent of about 1%.

KRÖHNKITE. $CuSo_4.Na_2SO_4+2H_2O$. A hydrous copper and sodium sulphate carrying 18.8% copper. Crystallization, monoclinic. Fracture, conchoidal. Hardness, 2.5. Gravity, 1.98. Lustre, vitreous. Color, azure-blue. Occurrence, Cobija, Atacama, Chile.

LAMPADITE. A cupriferous wad containing 3 to 15% copper.

LANGITE. $4CuO.SO_3.4H_2O$. A hydrous basic copper sulphate containing 53% copper. Is closely related to brochantite. Crystallization, orthorhombic. Hardness, 2.5 to 3. Gravity, 3.5. Lustre, vitreous on crystals, silky on crusts. Color, greenish blue. Is translucent. Occurrence, Cornwall, England.

LAUTITE. An imperfectly determined copper sulphoarsenite, of the enargite family, from Marienberg, Saxony.

LAVENDULAN. Chemical formula probably $3(Cu,Co,Ni)O.\ As_2O_5+3H_2O$. A hydrous copper, cobalt and nickel arsenate, containing about 32% copper, 2.5% cobalt monoxide and 1.35% nickel monoxide. Is related to trichalcite. Structure, amorphous. Fracture, conchoidal. Hardness, 2.5 to 3. Gravity, 3.01. Lustre, greasy to vitreous. Color, lavender blue. Streak, pale lavender blue. Diaphaneity, translucent. Is soluble in warm hydrochloric acid. Occurrence, Chile and Saxony.

LAXMANNITE. Vauquelinite.

LEPIDOPHAEITE. A varietal form of lampadite.

LETTSOMITE. Cyanotrichite.

LEUCOCHALCITE. $4CuO.As_2O_5.\ 3H_2O$. A hydrous basic copper arsenate, carrying about 39.8% copper. Structure, acicular. Lustre, silky. Color, light greenish white.

LIBETHENITE. $4CuO.P_2O_5.H_2O$. A hydrous copper phosphate carrying 51.1% copper. Common name, copper phosphate. Crystallization, orthorhombic. Fracture, subconchoidal to uneven. Tenacity, brittle. Hardness, 4. Gravity, 3.6 to 3.8. Lustre, resinous. Color and streak, olive-green. Diaphaneity, subtranslucent. Is soluble in nitric acid. Occurrence, Chile, Bolivia, England, Germany and Hungary.

LILIANITE. A lead sulphobismuthite, sometimes cupriferous to the extent of about 1.5%.

LIME-MALACHITE. Apparently merely a malachite carrying gypsum or calcite, or both, as impurities.

LINARITE. $PbO.CuO.SO_3.H_2O$. A basic lead and copper sulphate carrying 15.8% copper and 55.7% lead oxide. Crystallization, monoclinic. Fracture, conchoidal. Tenacity, brittle. Hardness, 2.5. Gravity, 5.3 to

5.45. Lustre, vitreous to adamantine. Color, deep azure-blue. Streak, pale blue. Diaphaneity, translucent. Occurs in many lead and copper districts.

LINDACKERITE. Chemical formula probably $3NiO.\ 6CuO.\ SO_3.\ 2As_2O_5.\ 7H_2O$. A hydrous copper and nickel sulphoarsenate containing 27.8% copper. Crystallization, orthorhombic. Hardness, 2 to 2.5. Gravity, 2 to 2.5. Lustre, vitreous. Color, verdigris-green to apple-green. Streak, pale green to white.

LINNAEITE. A cobalt sulphide in which cobalt frequently is replaced partially by nickel, iron or copper, latter to the extent of 1 to 8%.

LIROCONITE. $18CuO.\ 4Al_2O_3.\ 5As_2O_5.\ 55H_2O$. A hydrous basic copper and aluminum arsenate carrying 28.7% copper. Crystallization, monoclinic; also occurs rarely, granular. Cleavage, subconchoidal. Is imperfectly sectile. Hardness, 2 to 2.5. Gravity, 2.88 to 2.98. Lustre, vitreous. Color and streak, sky-blue to verdigris-green. Is soluble in nitric acid. Occurrence, Hungary and Cornwall, England.

LITHIDIONITE. A copper, iron, potassium and sodium silicate carrying circa 5.2% copper. Is an alteration product from Mt. Vesuvius.

LUNNITE. A name proposed for dihydrite, pseudomalachite and their varietal forms.

LUZONITE. A dimorphous form of enargite, found in the Mancayan-Suyoc district, Lepanto, Luzon, Philippines.

LYELLITE. Langite.

MALACHITE. $2CuO.\ CO_2.\ H_2O$. A basic copper carbonate carrying 57.5% copper. Common names, green copper carbonate, basic cupric carbonate. Crystallization, monoclinic. Commonly massive, but frequently incrustive and sometimes granular or earthy, and disseminated as stains. Fracture, subconchoidal to uneven. Tenacity, brittle. Hardness, 3.5 to 4. Gravity, 3.9 to 4.03. Lustre, of crystals, adamantine, frequently with concretionary bands of varying shades from pistachio-green to bluish green. Streak, green. Is opaque to translucent. Is soluble in nitric acid. Occurs in most copper districts, in the upper portions of the oxidized zones of ore bodies, and frequently is an important commercial ore. When massive and beautifully marked is a semi-precious stone, used for table tops, etc.

MALINOWSKITE. A plumbiferous and usually argentiferous variety of tennantite.

MARCYLITE. An imperfectly determined alteration product from copper sulphides, consisting of hydrated copper oxides and sulphides. Occurrence, Perú and Arkansas, U. S. A.

MARSHITE. Cu_2I_2. A copper iodide containing 33.4% copper. Crystallization, tetragonal. Fracture, subconchoidal. Tenacity, brittle. Lustre, adamantine. Color, oil-brown. Streak, orange-yellow. Is translucent. Occurrence, Broken Hill mines, New South Wales, Australia.

MELACONITE. Tenorite.

MELANOCHALCITE. $Cu_2(Si,C)O_4.Cu(OH)_2$. A copper silicate containing 61.4% copper. Structure, amorphous or cryptocrystalline, habit of crystals being undetermined. Hardness, 4. Gravity, 4.14. Lustre, vitreous. Color, jet black, powder is coffee-brown. Fine particles are translucent under high power of microscope, light passing through as yellowish brown.

Is decomposed by dilute hydrochloric acid, even a 3% solution changing a fragment into a white silicious mass retaining the original outlines, only cupric chloride being produced. Heated in a closed tube loses water and carbon dioxide, and powder changes in color from coffee-brown to brownish black. Heated with borax gives the sky-blue color of copper. With salt of phosphorous gives a skeleton of silica on the blue glass. SiO_2 and CO_2 replace each other within certain limits. From this fact, and the behavior of the mineral under dilute hydrochloric acid, it is deduced by Dr. Geo. A. Koenig, the discoverer, that there exists in it a compound orthoacid, $H_4(Si,C)O_4$, with the hydrogen replaced by copper. Viewed in this light melanochalcite represents the basic copper salt of the orthoacid. Occurs in the Calumet & Arizona mine, Bisbee, Arizona, the mineral surrounding cuprite as a black band, and being overlaid, in turn, by chrysocolla and malachite.

MELANOTHALLITE. Chemical formula probably $CuCl_2.CuO.2H_2O$. A copper oxychloride. Is an alteration product of Mt. Vesuvius.

MIARGYRITE. A silver sulphoantimonite, frequently cupriferous to the extent of one-half to one per cent.

MIXITE. Chemical formula probably $20CuO.\ Bi_2O_3.\ 5As_2O_5.\ 22H_2O$. A hydrated basic copper arsenobismuthite, carrying 35.2% copper. Occurs in acicular crystals. Hardness, 3 to 4. Gravity, 3.79. Color, whitish green to emerald-green or bluish green. Streak, lighter green. Is translucent, and, in fine particles, transparent. Occurrence, Baden, Germany, and Utah.

MOKAWKITE. $(Cu, Ni, Co)_3\ As$. A copper, nickel and cobalt arsenide, carrying 63 to 69% copper, 3 to 7% nickel and 0.5 to 2% cobalt, usually somewhat argentiferous. Crystallization, hexagonal, by synthesis, no crystals being found in nature. Cleavage, indistinct. Fracture, uneven. Tenacity, slight. Hardness, 4. Gravity, 8.05. Color, light gray on fresh fractures, tarnishing to purple or brassy yellow. Streak, gray. Is soluble in nitric acid. Occurrence, Mohawk mine, Keweenaw county, Michigan.

MOHAWK-WHITNEYITE. Cu_9As. A copper arsenide, carrying 83 to 87% copper. Is a mere name of convenience for an intimate blending of mohawkite and whitneyite, or keweenawite and whitneyite, indistinguishable to the eye but determined chemically. Cleavage, none. Fracture, hackly. Tenacity, is malleable, to only a slightly less extent than copper. Hardness, about 5. Gravity, 8.6. Color, gray, with a yellowish tinge, tarnishing to coffee-brown. Streak, gray. Is soluble in nitric acid, with a small residue of gray powder. Occurrence, at Mohawk mine, Keweenaw county, Michigan.

MOTTRAMITE. Chemical formula undetermined. A hydrous basic lead and copper vanadate containing about 16.3% copper. Is very closely related to psittacinite.

MOUNTAIN BLUE. Common name for azurite.

MOUNTAIN GREEN. Common name for malachite. Name sometimes is applied to chrysocolla also.

MYSORIN. An impure malachite from Mysore, India.

NAMAQUALITE. Chemical formula probably $2CuO.Al_2O_3.4H_2O$. A hydrated copper and aluminum oxide, carrying 35.8% copper. Occurrence, Little Namaqualand, Cape Colony.

NANTOKITE. Cu_2Cl_2. A copper chloride, carrying 84.1% copper. Crystallization, isometric; also occurs massive and granular. Cleavage, cubic. Fracture, conchoidal. Hardness, 2 to 2.5. Gravity, 3.9. Lustre, adamantine. Color, grayish white to colorless. Is translucent to transparent. Is soluble in nitric or hydrochloric acids, and in ammonia. Yields chlorine when sharply struck. Oxidizes readily on exposure to atmosphere. Occurrence, Carmen Bajo mine, Chile, and Broken Hill mines, New South Wales.

OCTAHEDRAL COPPER ORE. Common name for cuprite.

OLIVE GREEN COPPER ORE. Common name for olivenite.

OLIVENITE. $4CuO.As_2O_5.H_2O$. A hydrous basic copper arsenate, carrying 44.8% copper. Common name, olive green copper ore. Crystallization, orthorhombic, with prismatic and acicular crystals; also occurs globular and granular. Fracture, conchoidal to uneven. Tenacity, brittle. Hardness, 3. Gravity, 4.1 to 4.4. Lustre, adamantine to vitreous. Color, olive-green to blackish green. Is opaque to subtransparent. Is soluble in nitric acid. Occurrence, Nijni Tagilsk, Perm, Russia, Cornwall and Devon, England, Chile, Utah, etc.

ORILEYITE. $(Cu_2, Fe)_3 (As, Sb)_2$. A copper and iron arsenoantimonite, carrying 12.13% copper. Is related to stibiodomeykite. Structure, massive. Hardness, 5.5. Gravity, 7.4. Lustre, metallic. Color, steel-gray, with purplish tinge on fresh fracture. Streak, dark gray. Occurrence, Burmah.

PARAMELACONITE. CuO. A copper oxide carrying 79.3% copper. Is a dimorphous form of melaconite. Crystalfization, tetragonal. Hardness, 5. Gravity, 5.83. Lustre, brilliant. Color, purplish black on faces, pitch-black on fractures. Occurrence, with footeite, at Bisbee, Arizona.

PARTZITE. Chemical formula undetermined. A hydrous copper antimonite, carrying circa 28.7% copper. Fracture, conchoidal. Hardness, 3 to 4. Gravity, 3.8. Color, yellowish green to blackish green. Occurrence, Mono county, California.

PEACOCK ORE. Common name for bornite. Sometimes is applied also to chalcopyrite when showing an iridescent tarnish.

PEARCEITE. Chemical formula probably $9(Ag,Cu)_2S.As_2S_3$. A silver and copper sulphoantimonite. Crystallization, rhombohedral; also occurs massive. Cleavage, none. Fracture, conchoidal. Tenacity, brittle. Hardness, 3. Gravity, 6.125. Lustre, metallic. Color and streak, black. Occurrence, Aspen, Colorado.

PELOCONITE. A varietal form of lampadite.

PENTLANDITE. An iron and nickel sulphide carrying up to 1.75% copper.

PERCYLITE. Chemical formula probably $PbCuO.Cl_2.H_2O$. A hydrous lead and copper oxychloride carrying circa 17% copper. Crystallization, isometric. Hardness, 2.5. Color and streak, sky-blue. Occurrence, Chile, Bolivia, South Africa and Mexico.

PHILLIPITE. $CuSO_4.Fe_2(SO_4)_3+nH_2O$. A hydrous copper and iron sulphate, carrying 11.5% copper. Structure, granular and fibrous. Lustre, vitreous. Color, azure-blue. Diaphaneity, translucent. Taste, astringent. Is soluble in water. Occurrence, Los Condes, Santiago de Chile.

PHOSPHOROCHALCITE. $6CuO.P_2O_5.3H_2O$. A hydrous basic copper phosphate, closely related to dihydrite and pseudomalachite.

PHOSPHOCHROMITE. Vauquelinite.

PILARITE. An aluminous variety of chrysocolla, from Chile.

PISANITE. $(Fe,Cu)SO_4+7H_2O$. A hydrous iron and copper sulphate, carrying variable percentages of copper. Practically is a cupriferous melanterite, or copperas. Crystallization, monoclinic. Lustre, vitreous. Color, bright blue. Occurrence, Italy and Turkey.

PLANERITE. A hydrous aluminum, copper and iron phosphate, carrying circa 2.8% copper. Occurrence, Gumishevsk, Perm, Russia.

PLUMBOCUPRITE. Cuproplumbite.

PLUSH COPPER ORE. Common name for cuprite.

POLYBASITE. $9(Ag,Cu)S.Sb_2S_3$. A silver and copper sulphoantimonite carrying 3 to 10% copper and 62 to 72% silver. Crystallization, orthorhombic. Fracture, uneven. Hardness, 2 to 3. Gravity, 6 to 6.2. Lustre, metallic. Color, iron-black, in thin splinters cherry-red. Streak, black. Is nearly opaque. Occurrence, Guanajuato, Mexico, Colorado, etc.

PRASINE. A varietal form of dihydrite, containing alumina, silica and arsenic in small amounts, apparently merely as impurities.

PSEUDOBOLÉITE. Cumengite.

PSEUDOLIBETHENITE. Libethenite.

PSEUDOMALACHITE. $6CuO.P_2O_5.3H_2O$. A hydrous basic copper phosphate containing 53.5% copper. Is closely related to dihydrite, but has one extra unit each of cupric oxide and water. Structure, massive, reniform and botryoidal. Hardness, 4.5 to 5. Gravity, 3.4 to 4.4. Lustre, vitreous. Color, emerald-green to blackish green. Streak, paler green.

PSITTACINITE. Chemical formula probably $4(Pb, Cu).V_2O_5.2H_2O$. A hydrous basic lead and copper vanadate, containing circa 15.4% copper. Structure, pulverulent. Color, olive-green. Occurrence, Argentina and Montana.

PURPLE COPPER ORE. Common name for bornite.

PYRITES OF COPPER. Common name for chalcopyrite.

RABDIONITE. Chemical formula uncertain. A hydrated iron, manganese and copper oxide, containing 11.2% copper. Is very soft. Gravity, 2.8. Lustre, dull. Color, black. Streak, dark brown. Occurrence, Nijni Tagilsk, Perm, Russia.

RAHTITE. An impure cupriferous sphalerite.

RAMIRITE. Cuprodescloizite.

RED COPPER ORE. Common name for cuprite.

RED GLASSY COPPER ORE. Common name for cuprite.

REDRUTHITE. Chalcocite.

REGNOLITE. $5CuS.FeS.ZnS.As_2S_5$. A copper, iron and zinc sulpharsenite containing 32.6% copper. Is closely related to sandbergerite. Crystallization, tetragonal. Occurrence, Cajamarca, Perú.

RESANITE. Chemical formula uncertain. A hydrous copper and iron silicate, containing circa 18.5% copper. Structure, massive. Color, olive-

green. Is soluble in hydrochloric acid. Occurence, Luquillo, Porto Rico, associated with chrysocolla and malachite.

REZBANYITE. A lead sulphobismuthite, usually cupriferous to the extent of 1.75 to 3.75%.

RICHMONDITE. A cupriferous variety of beegerite, which is, normally, a lead sulphobismuthite.

RICKARDITE. $Cu_2Te.2CuTe$. A copper telluride containing 40.5% copper. Structure, massive. Fracture, irregular. Hardness, 3.5. Gravity, 7.54. Color, brilliant purple, rivaling bornite tarnish, even on a fresh fracture, and showing deep color when pulverized. Is fusible on charcoal and soluble in nitric acid. Occurrence, Good Hope mine, Vulcan, Colorado.

RIONITE. A bismuthiferous variety of tennantite.

RIVOTITE. Chemical formula uncertain. A copper and antimony carbonate carrying circa 31.6% copper. Structure, amorphous, compact. Fracture, uneven. Tenacity, fragile. Hardness, 3.5 to 4. Gravity, 3.55 to 3.62. Color, yellowish green to grayish green. Streak, grayish green. Occurrence, Lerida, Spain.

RUBY COPPER. Common name for cuprite.

SAFFLORITE. A cobalt diarsenide, usually cupriferous to the extent of 0.25 to 4.25%.

SALVADORITE. $FeSO_4.7H_2O.2(CuSO_4).7H_2O$. A hydrous copper and iron sulphate carrying circa 14.5% copper. Is near pisanite. Crystallization, monoclinic. Lustre, vitreous. Color, bluish green. Occurrence, Calama, Antofagasta, Chile.

SANDBERGERITE. A ferruginous, plumbiferous and zinciferous variety of tennantite, from Perú.

SCHULZENITE. Chemical formula probably $CuO.2CoO.Co_2O_3+4H_2O$. A hydrous copper and cobalt oxide. Structure, amorphous. Fracture, conchoidal. Hardness, 3.5. Gravity, 3.39. Color and streak, black. Occurrence, Chile.

SCHWATZITE. A mercurial tetrahedrite, in which mercury replaces copper variably, usually to the extent of about 15% of the total. Gravity, 5.10. Lustre, dull. Color, dark gray to iron-black.

SERPIERITE. $3(Cu,Zn,Ca)SO+3H_2O$. A hydrous basic copper, zinc and calcium sulphate, containing 28.8% copper. Crystallization, orthorhombic. Color, bluish green. Is transparent. Occurrence, Laurium, Greece.

SIEGENITE. A nickeliferous variety of linnæite, frequently carrying small percentages of copper.

SMALTITE. Empirically cobalt disulphide, but frequently carrying copper in quantities from a mere trace to 3.25%.

SOMERVILLITE. $CuSiO_3.4H_2O$. A hydrous copper silicate, corresponding in formula with chrysocolla and asperolite, except as to excess of water. From Somerville, Somerset county, New Jersey.

SPANGOLITE. Chemical formula probably $(AlCl)SO_4.6Cu(OH)_2+3H_2O$. A basic copper and aluminum chlorosulphate, carrying circa 47.7% copper. Crystallization, rhombohedral. Fracture, conchoidal. Hardness, 2 to 3.

Gravity, 3.14. Lustre, vitreous. Color, dark green. Occurrence, Cochise county, Arizona.

SPANIOLITE. An imperfectly established variety of schwatzite.

STANNITE. Chemical formula probably Cu_2S. FeS. SnS_2. A copper, iron and tin sulphide, containing 29.5% copper, 13.1% iron and 27.5% tin. Structure, massive, granular and disseminated. Cleavage, cubic, indistinct. Fracture, uneven. Tenacity, brittle. Hardness, 4. Gravity, 4.3 to 4.5. Lustre, metallic. Color, steel-gray when pure, ranging to iron-black when impure, latter with bluish to yellowish tarnish. Streak, blackish. Occurrence, County Wicklow, Ireland, and Cornwall, England.

STELZUERITE. Chemical formula uncertain. A basic copper sulphate, closely related to brochantite. Crystallization, orthorhombic. Hardness, 3.5 to 4. Gravity, circa 3.9. Lustre, vitreous. Color, dark emerald-green to blackish green. Streak, lighter green. Is translucent to transparent. Occurrence, Chile, associated with brochantite and atacamite, and frequently mistaken for both.

STETEFELDTITE. A hydrous copper antimonite, carrying circa 12.8% copper. Structure, massive. Hardness, 3.5 to 4.5. Gravity, 4.12 to 4.24. Color, brown to blackish. Streak, shining. Occurrence, Nevada.

STIBIODOMEYKITE. $Cu_3(As,Sb)$. A copper arsenoantimonite containing circa 65% copper. Apparently is an antimonial domeykite. Crystallization, hexagonal in synthetic crystals, none being found in nature. Cleavage, none. Fracture, uneven. Tenacity, very slight. Hardness, 4. Gravity, 8.1. Lustre, metallic. Color, gray, with yellowish tinge, like domeykite. Streak, gray. Is soluble in nitric acid, with small residue of gray powder. Occurrence, Mohawk mine, Keweenaw county, Michigan.

STYLOTYPITE. $3(Cu_2Ag_2Fe)S.Sb_2S_3$. A copper, silver and iron sulphobismuthite carrying 28.3% copper and 8.1% silver. Apparently is an argentiferous and ferruginous bournonite. Crystallization, orthorhombic. Fracture, imperfectly conchoidal. Tenacity, brittle. Hardness, 3. Gravity, 4.8. Lustre, metallic. Color, iron-black. Streak, black. Occurrence, Copiapó, Chile.

STROMEYERITE. $(Ag,Cu)_2S$. A silver and copper sulphide, carrying 31.1% copper and 53.1% silver. Crystallization, orthorhombic. Fracture, subchonchoidal. Hardness, 2.5 to 3. Gravity, 6.15 to 6.3. Lustre, metallic. Color and streak, dark steel-gray. Occurrence, Chile, Perú, Siberia, Colorado, etc.

STÜBELITE. Chemical formula undetermined. A hydrous manganese, copper, iron and aluminum silicate, carrying circa 12% copper. Structure, massive, reniform and botryoidal. Fracture, conchoidal. Tenacity, brittle. Hardness, 4 to 5. Gravity, 2.22 to 2.26. Lustre, vitreous, brilliant. Color, velvet-black to pitch-black. Streak, dark brown.

STUDERITE. A varietal form of tennantite containing, as partial replacement of normal copper content, silver, lead, zinc and iron.

SUB-OXIDE OF COPPER. Cuprite in mineralogy; cuprous oxide in chemistry.

SYCHNODYMITE. $(Co,Cu,Ni)_4S_5$. A cobalt, copper and nickel sulphide, containing circa 14.5% copper. Crystallization, isometric. Gravity,

4.75. Lustre, metallic. Color, steel-gray. Is soluble in nitric acid. Occurrence, Eiserfeld, Siegen, Germany.

TAGILITE. $4CuO.P_2O_5.3H_2O$. A hydrous basic copper phosphate containing 49.4% copper. Crystallization, monoclinic; also occurs in spheroidal concretions with structure fibrous to earthy. Fracture, uneven. Tenacity, brittle. Hardness, 3 to 4. Gravity, 4.08. Lustre, vitreous. Color, verdigris-green to emerald-green. Diaphaneity, substranslucent. Is soluble in nitric acid. Occurrence, Coquimbo, Chile and Nijni Tagilsk, Perm, Russia.

TALLINGITE. Chemical formula probably $Cu_5(OH)_8Cl_2+4H_2O$. A hydrated copper oxychloride containing circa 64% copper. Structure, subcrystalline. Hardness, 3. Gravity, circa 3.5. Color, greenish blue. Streak, white. Is subtranslucent. Occurrence, Botallack, mine, Cornwall, England.

TARGIONITE. Apparently merely an impure galena carrying circa one per cent each of copper, silver and zinc, from Tuscany, Italy.

TENNANTITE. $4Cu_2S.As_2S_3$. A copper sulphoarsenite containing 57.5% copper when pure, but shading into a great number of varietal forms. Common name, gray copper ore, in common with tetrahedrite, to which tennantite is closely related and joined by a chain of rather obscure minerals shading gradually from tennantite into tetrahedrite. The many varietal forms of this mineral are brought about by partial replacement of copper by silver, lead, zinc, iron, mercury, cobalt, nickel, tin and platinum, with a marked tendency toward mutual substitution of the antimony of tetrahedrite for the arsenic of tennantite, and vice versa, rendering the tetrahedrite-tennantite group unusually prolific. Crystallization, isometric; also occurs massive and granular, compact. Cleavage, none. Fracture, subconchoidal. Tenacity, brittle. Hardness, 3.5 to 4.5. Gravity, 4.4 to 5.1. Lustre, metallic. Color and streak, flint-gray to iron-black. Diaphaneity, opaque to subtranslucent in small splinters. Is soluble in nitric acid and fusible on charcoal. Occurrence, at numerous points, being found in greater or less profusion in most copper districts. Is not regarded usually as a commercial ore, except where argentiferous, which is quite commonly the case.

TENORITE. CuO. A copper oxide, containing 79.8% copper. Common names, black copper, black oxide of copper. Chemical names, copper monoxide, copper peroxide, cupric oxide. Crystallization, monoclinic; also occurs massive, pulverulent and earthy. Fracture, conchoidal to uneven. Hardness, 3 to 4. Gravity, 5.8 to 6.25. Lustre, metallic. Color, dull grayish-black when massive, steel-gray in flakes. Is soluble in nitric and hydrochloric acids. Is found in most copper districts, and is a valuable ore of copper when occurring in quantities, but much of what has been considered tenorite in the past really was chalcocite, for which it is easily mistaken when disseminated.

TETRAHEDRITE. $4Cu_2S.Sb_2S_3$. A copper sulphoantimonite containing 52.1% copper. Shades into tennantite, which see, for reference to protean forms of these two closely related and frequently indistinguishable minerals. Common name, gray copper ore. Crystallization, isometric; also occurs massive and granular, coarse to fine, compact. Cleavage, none. Fracture, subconchoidal to uneven. Tenacity, brittle. Hardness, 3.5 to 4.5. Gravity, 4.4 to 5.1. Lustre, metallic, brilliant. Color, flint-gray to

iron-black. Streak, grayish-brown to cherry-red. Opaque in quantity, but occasionally subtranslucent in very thin splinters, giving cherry-red transmitted light. Is soluble in nitric acid and fusible on charcoal. Occurrence, in most copper districts, but commonly is not regarded as a commercial ore, except when argentiferous, which frequently is the case.

THROMBOLITE. An imperfectly determined hydrous copper antimonate, carrying circa 31.5% copper. Structure, amorphous. Color, emerald-green. Occurrence, Rezbánya, Hungary.

TIEMANNITE. An imperfectly determined silver, mercury and copper selenide, carrying circa 8.8% copper. Occurrence, with eucairite and umangite, in the Sierra de Umango, Rioja, Argentina.

TORBERNITE. $CuO.2UO_3.P_2O_5.H_2O$. A hydrous uranium and copper phosphate, carrying 6.9% copper. Common name, uranium mica. Crystallization, tetragonal. Cleavage, micaceous, with brittle laminae. Hardness, 2 to 2.5. Gravity, 3.4 to 3.6. Lustre, pearly on cleavage planes and subadamantine on other faces. Color, emerald-green to grass-green. Streak, apple-green. Diaphaneity, translucent to transparent. Is soluble in nitric acid. Occurrence, Cornwall, Saxony, etc.

TRICHALCITE. $3CuO.As_2O_5+5H_2O$. A hydrous copper arsenate containing 34% copper. Structure, in radiated groups, columnar, also dendritic. Hardness, 2.5. Lustre, silky. Color, verdigris-green. Is soluble in hydrochloric acid. Occurrence, Russia.

TRIPPKEITE. ($nCuO.As_2O_3$.) A copper arsenite. Crystallization, tetragonal. Color, bluish-green. Is soluble in acids. Occurrence, Copiapó, Chile, in druses.

TRITOCHORITE. Cuprodescloizite.

TURQUOISE. A gemstone, essentially a hydrous aluminum phosphate, colored by 2 to 6% of copper, which probably is included as a hydrous basic copper phosphate.

TYROLITE. $CuO.As_2O_5.9H_2O$. A hydrous basic copper arsenate carrying 40.1% copper. Crystallization, orthorhombic. Cleavage, micaceous. Tenacity, highly sectile and flexible in thin laminæ. Hardness, 1 to 1.5. Gravity, 3.02 to 3.1. Lustre, pearly to vitreous. Color, verdigris-green to apple-green. Diaphaneity, subtranslucent to translucent. Occurrence, Libethen, Hungary, Utah, etc.

UMANGITE. Cu_3Se_2. A copper selenide containing 54.6% copper. Structure, massive. Cleavage, none. Fracture, subchonchoidal to uneven. Hardness, 3. Gravity, 5.62. Lustre, metallic. Color, dark cherry-red, with violet tinge on fresh fracture, soon tarnishing to violet-blue. Streak, black. Occurrence, with tiemannite and eucairite, in the Sierra de Umango, Rioja, Argentina.

URANIUM MICA. Common name for torbernite.

URANOCHALCITE. Chemical formula undetermined. A hydrous basic uranium and copper sulphate carrying circa 5% copper. Occurs in acicular crystals. Hardness, 2 to 2.5. Color, grass-green. Occurrence, Joachimsthal, Bohemia.

VALLERIITE. A sulphate of copper, iron, aluminum and magnesium.

Apparently is a mixture of covellite, pyrrhotite and several aluminous and magnesian minerals. Occurrence, Nya Kopparberg, Sweden.

VARIEGATED COPPER ORE. Common name for bornite.

VAUQUELINITE. Chemical formula probably $2(Pb,Cu)CrO_4.(Pb,Cu)_3P_2O_8$. A lead and copper phosphochromate carrying 3.9 to 10% copper. Crystallization, monoclinic; also occurs amorphous. Fracture, uneven. Tenacity, brittle. Hardness, 2.5 to 3. Gravity, 5.8 to 6.1. Lustre, adamantine to resinous. Color, apple-green to liver-brown. Streak, greenish to brownish. Diaphaneity, opaque to faintly translucent. Occurrence, Berezov, Russia.

VELVET COPPER ORE. Common name for cyanotrichite.

VENERITE. A hydrous copper, aluminum, iron and magnesium silicate containing circa 14% copper. Occurrence, Springfield, Berkshire county, Pennsylvania.

VERDIGRIS. Copper carbonate. Is formed from metallic copper by the action of carbon dioxide and moisture in the atmosphere. The verdigris of the pharmacist is a copper acetate and care should be taken not to confuse these widely varying compounds bearing the same name.

VESZELYLITE. Chemical formula probably $7(Cu,Zn)O.(P,As)_2O_5.9H_2O$. A hydrous copper arsenophosphate carrying circa 30% copper. Crystallization, monoclinic. Hardness, 3.5 to 4. Gravity, 3.53. Color and streak, greenish blue. Occurrence, Moravitza, Hungary.

VOGLITE. Chemical formula uncertain. A hydrous uranium, calcium and copper carbonate carrying circa 6.9% copper. Occurs in aggregations of crystalline scales. Lustre, pearly. Color, emerald-green to bright grass-green.

VOLBORTHITE. Chemical formula probably $(Cu,Ca,Ba)_3(OH)_3VO_4+6H_2O$. A hydrous basic copper, calcium and barium vanadate carrying circa 30.9% copper. Hardness, 3 to 3.5. Gravity, 3.55. Lustre, pearly to vitreous. Color, olive-green to citron-yellow. Streak, greenish yellow. Is translucent in thin splinters. Occurrence, Perm, Russia.

WARRINGTONITE. A varietal form of brochantite.

WHITNEYITE. Cu_9As. A copper arsenide containing 88.4% copper. Structure, massive, crystalline, very finely granular. Tenacity, malleable. Hardness, 3.5. Gravity, 8.4 to 8.6. Lustre, dull and submetallic on fresh fracture, strongly metallic when scratched, soon tarnishing. Color, pale reddish to grayish white, pale reddish white on a rubbed surface, tarnishing to yellowish bronze, brown and brownish black, sometimes with iridescence. Is soluble in nitric acid. Occurrence, Houghton, Michigan, Sonora, Mexico, and Chile.

WINKLERITE. Chemical formula uncertain. A hydrous cobalt, nickel and copper arsenate carrying circa 11 to 12% copper. Structure, amorphous, massive. Fracture, conchoidal. Hardness, 3. Gravity, 3.43. Lustre, dull. Color, bluish black to violet black. Streak, dark brown. Occurrence, Almería, Spain.

WITTICHENITE. $3Cu_2S.Bi_2S_3$. A copper suphobismuthite carrying 38.4% copper. Crystallization, orthorhombic. Fracture, conchoidal. Hardness, 3.5. Gravity, 4.3 to 5. Color, steel-gray to tin-white, tarnishing to

pale lead-gray. Streak, black. Is soluble in nitric or hydrochloric acids. Decomposes easily on charcoal. Occurrence, Wittichen, Baden, Germany.

WÖLCHITE. A varietal form of bournonite.

WOLFSBERGITE. Chalcostibite.

WOOD COPPER. Common name for olivenite.

WOODWARDITE. Chemical formula uncertain. An aluminum and copper sulphate containing circa 38.4% copper. Is closely related to langite.

YELLOW COPPER ORE. Common name for chalcopyrite.

YPOLÉIME. Chemical formula perhaps $5CuO.2P_2O_5.5H_2O$. A doubtful hydrous basic copper phosphate of the dihydrite-pseudomalachite group.

ZEUNERITE. $CuO.2UO_3.As_2O_5.8H_2O$. A hydrous uranium and copper arsenate containing 6.1% copper. Crystallization, tetragonal. Fracture, uneven. Tenacity, brittle. Hardness, 2 to 2.5. Color, grass-green to emerald-green. Occurrence, Saxony and Cornwall, England.

ZINKAZURITE. Apparently merely a hydrous mixture of copper carbonate and zinc sulphate, from the Sierra Almagrera, Spain.

ZINKENITE. A lead sulphoantimonite, usually slightly cupriferous.

ZIPPEITE. Chemical formula undetermined. A hydrous basic uranium, copper and calicum sulphate. Occurs in acicular crystals and crusts. Hardness, 3. Color, lemon-yellow to orange-yellow. Occurrence, Joachimsthal, Bohemia.

ZORGITE. Chemical formula uncertain. A lead and copper selenide, carrying 4 to 15.5% copper and 41 to 64% lead, with traces of silver, mercury and iron. Structure, massive and granular. Tenacity, brittle. Hardness, 2.5. Gravity, 7 to 7.5. Lustre, metallic. Color, lead-gray. Streak, darker lead-gray. Occurrence, Cacheuta, Mendoza, Argentina.

CHAPTER IV.

THE MINING OF COPPER.

Large volumes have been written and printed regarding the general subject of ore extraction, and many smaller books have been issued on single branches of mining practice, such as timbering, pumping, use of explosives, etc. Under these circumstances it is obvious that merely an outline can be given, in a single short chapter on the subject of the actual extraction of copper and copper ore. In its main features copper mining is much the same as other branches of metalliferous mining, but there are some special features of interest.

Title to mining lands is secured and held in different ways in different countries. In England and her colonies, mining property usually is held either as freehold, when owned in fee, or as leasehold, when operated by other than the owner of the land. In most of the colonies, especially in the Australian states and in British Columbia, public lands are available for location, on terms favorable to mining operations. In the United States practically all of the land east of the Mississippi River is held by private owners, to whom pertain the mineral rights, as well as the ownership of the surface of the land. In the states and territories from the Rocky Mountains westward to the Pacific coast there are immense areas of mountainous mineral lands, owned by the government, and available for the location of mining claims. The full mining claim allowed by the United States laws is a parallelogram of 600 by 1,500 feet, with its longest dimension practically coincident with the axis of strike of some mineral body. Claims may be fractional, where the full size permitted cannot be secured because of surrounding claims previously located. The locator of a claim must make affidavit that he has found mineral in place, but this requirement is more honored in the breach than in the observance. There is no limit to the number of claims that may be located by a single person, firm or corporation. Neither is there anything to prevent other locators staking out claims impinging upon or covering claims previously located. In many mineral districts there is much litigation, owing to infringing claims. United States mineral claims are of two varieties, one known as a quartz or lode claim, previously referred to, and a second variety, of greater area, known as a placer claim, located for placer gold. The locator of a mineral claim on United States government land is required to do annual work, usually called assessment work, to the value of $100 on each claim, until the end of five years, when, upon satisfactory proof to the land office that $500 worth of work has been done, a government patent will issue for such lands. In the case of a group of contiguous claims, assessment work may be done, by shaft or tunnel, on a single claim of the group, instead of being divided among the individual claims. In actual practice a 10-foot tunnel or a 10-foot pit is considered equivalent to $100 worth of work, though ranging in cost from $35 to $50, as a rule. In Mexico and several others among the Latin-American coun-

tries, surface title does not carry the ownership of mineral values, which pertain to the state. No permanent titles to mineral properties are given in Mexico, but these are held subject to the payment of regular taxes of 10 pesos per pertenencia of one hectare area, and upon non-payment of taxes title to the lands is forfeited automatically.

The law of the apex in the United States is that the owner of a vein that outcrops at surface may follow such vein to any depth, at any dip, regardless of side boundary lines at surface. This law is the cause of endless confusion, and in some of the best mining camps, notably at Bisbee and Leadville, side-line agreements are made between the owners of different claims, by which they agree mutually that the law of the apex shall be waived. The law of the apex holds only in the mining states west of the Mississippi river, and is unknown in the Lake Superior district and other eastern mining fields.

Ore may outcrop at the surface, or may be overlaid by alluvium consisting of sand, gravel and boulders to depths ranging from a few feet to hundreds of feet. Ore bodies also may be overlaid by eruptions of rhyolite or similar flows laid down after the deposition of mineral values. Every property must be a prospect before it can be a mine, and prospects divide naturally into two classes, one showing outcrops and the other having its ore bodies covered by dirt or rock. Ore bodies not outcropping at surface may be proven by the use of the churn drill or diamond drill. The diamond drill has a hollow cylindrical bit, set on its inner and outer edges with black diamonds. This bit is rotated by means of pipes connecting with the machine above, and bores a hole of hundreds, or if necessary, of thousands of feet, in depth, cutting a core that gives a complete record of the formation penetrated. In soft ground no solid cores can be secured, and in such cases it is necessary to collect rock cuttings from the sludge that falls from the mouth of the hole, water being forced into the bottom of the hole under pressure to remove the chips and rock dust. The churn drill cuts no core, but is valuable for exploratory purposes, in most cases being cheaper than the diamond drill for shallow borings.

Unknown ground may be proven also by test-pits or trenches. Test-pits, usually shallow, sometimes are sunk for several hundred feet in depth, and may be made into permanent shafts. In the Lake Superior district, where nearly all of the shafts are sunk on inclines, at the angles of dip of the cupriferous beds, it is customary, in opening mines on beds covered with heavy drift, to sink temporary vertical shafts through the alluvium and from twenty to fifty feet into the solid rock. From the bottom of such a temporary shaft a crosscut is run to the desired bed, and the permanent shaft frequently is opened to surface by means of an upraise, after which the permanent shaft is deepened on the bed. A sand shaft is a shaft sunk through sand to the rock ledge, and frequently is very difficult in sinking. A drop shaft is one that is sunk through sand or alluvium by weights piled on the top of the timbering. The bottom is shod with steel, to facilitate its descent through the soft material, and new timbers are framed in at the top, until the solid rock is reached.

Copper mines may be divided into two classes, according to their system of opening. The first of these is the quarry or open-cast mine, while the other is a mine proper, with subterranean openings. In working

mines open-cast it frequently is necessary to remove the overburden of alluvium, sometimes of considerable depth, preparatory to quarrying the ore. Some of the open-cast mines are worked exclusively as quarries, and others in combination with underground openings, where ore broken down in large open pits is milled through winzes to tunnels beneath, for removal in tram-cars. The mine of the Utah Copper Company, in Bingham, Utah, is worked in benches, by steam shovels, this plan being rendered possible by the enormous size of the ore body, which is a mountain of cupriferous monzonite.

By far the greater number of copper mines, as well as mines of nearly all other minerals, are developed by strictly underground openings. The underground mines fall into two classes, the first being those opened by adits or tunnels, and the second those that depend upon shafts for ore extraction. Tunnel mining, so called, is where the principal avenue of ore extraction is through a practically horizontal opening, commonly called a tunnel, though more properly termed an adit, as, strictly speaking, a tunnel opens to the surface at both ends. The tunnels are given a slight rise from the portal, to provide drainage, and also to obtain the aid of gravity in removing loaded cars. The principal advantage of tunnel mining is that it permits cheap development and extraction, by reason of requiring no pumps or costly machinery for hoisting. In mountainous districts tunnels frequently give good backs—that is large ore bodies above the tunnel level. A disadvantage of development by tunnel is that it sometimes operates to restrain development at a greater depth, because of the hesitation of the mine managment in making the heavy outlay required for hoisting machinery and pumps. Many copper mines are combinations of tunnel and shaft mines, having been opened by tunnel originally, and deepened later by shaft.

All underground openings in a mine may be divided into three classes, of which the first includes the openings made upon a practically horizontal plane, while the second includes the openings that range from a very flat dip to vertical. The third class includes stopes and chambers of varying size and trend.

The horizontal openings include not only the adits and tunnels previously referred to, but also plats, drifts and crosscuts. A plat is the beginning of a drift, cut out beside a shaft. A drift is like a tunnel, except that it starts from some underground opening and usually is smaller in size than a tunnel. A crosscut is an opening on a horizontal plane, like a drift, except that it runs across an ore body instead of with it. The word level is more comprehensive than the word drift and includes all horizontal openings on that particular plane, such as adits, tunnels, plats, drifts, crosscuts, stopes and chambers.

The second class of openings, includes shafts and winzes, the winze being a connection, or the beginning of a connection, between levels. In the old system of mining levels usually were 10 fathoms or 60 feet apart, and sometimes even closer. Modern mining practice usually provides levels at 100 foot intervals, and occasionally levels are placed 150 feet apart, in which case sub-levels are driven when necessary.

Of the third class of mine openings, a stope is any ore body developed by horizontal openings that is available for ore extraction, and the term

is applied also to the chamber left by extraction of the ore. Stoping the actual mining of ore, as distinguished from opening work, whi merely provides the preliminary underground passages necessary to actu ore extraction on a considerable scale.

The reopening of an old mine is a task that is both nasty and danger ous, owing to rotten timbers and mine openings filled with water, usuall with considerable rubbish at the bottom of the shafts. Frequently suc reopening work must be done by the aid of defective mine maps, or with out any maps whatever. Old shafts frequently are cut down to large size, the cutting down being a process of enlargement and retimbering.

Shafts frequently are vertical, and may be sunk at any angle corresponding with the dip of the ore body that is being developed, though in actual practice shafts rarely are sunk flatter than an angle of 25° with the horizon. Shafts usually are divided into compartments by timber cribbing. Sometimes the cribbing is open, and again very close. The various compartments are utilized for hoisting, for ladders providing ingress and egress, and for air-pipes, water-pipes and wires. The ladderway usually is timbered off solidly from the other compartments, and usually has sollars, or landings, at stated intervals, for both convenience and safety. At all levels there usually are platforms with openings just large enough for the cages, or skips, to pass through. An air-shaft is one that is used for purposes of ventilation only, being either a shaft sunk for that sole purpose, or an old shaft otherwise useless. A blind shaft is one that does not come to the surface, usually connecting with a tunnel. An upraise is a winze or shaft, or the beginning of either, made by working upward. The upper workings of a mine frequently are in soft rock, o ore softened by oxidation, and such openings require heavy timbering fo safety. In the case of mines opened on soft veins having strong wall there is considerable advantage in sinking the incline shaft in the footwal at a depth of 25 to 75 feet under the ore, the shaft following the same di as the vein and running parallel therewith. In the case of a vertical sha there is a similar advantage in sinking in the footwall and crosscutting fc the ore body, unless the depth and dip are such that this plan necessitate crosscuts of prohibitory lengths.

Vertical shafts have guides in each compartment, along which th cage travels. The cage is merely a rough elevator, and hoisting common is done in counterbalance. This may be accomplished by the use of single drum with a fleet-gear, or by hoisting with a split drum. In th case of a very deep vertical shaft with hoisting done by cages in counte balance, tail-ropes running from the bottom of each cage around sheave-wheel in the bottom of the shaft prevent excessive vibration. Hois ing in vertical shafts usually is done in cages, which raise the loaded trai cars and lower the empty cars from surface, but a comparatively rece development is the Kimberly skip, which is swung under the cage. T Kimberly system calls for one, two or even three skips, swung under t cage. The skips discharge automatically into bins, on reaching the su face. The utilization of the Kimberly system of hoisting in deep vertic shafts increases their capacity by 25 to 50 per cent., according to circu stances.

As a rule incline shafts sould be sunk at a constant angle, wh

e last stage calls for permanent hoists, these ranging up to thous-
of horse-power in capacity in some large and deep mines. For an
it a derrick with mast and boom may be used for hoisting ore in a
. The simplest headgear over a shaft is a tripod of three sticks
ber. The next stage is a gallows-frame, which may be small or large,
f wood or steel, the tendency at the larger mines being strongly
building all important surface structures with steel frames. Shaft-
, which are enclosed structures, may be of wood or steel, with a
preference for steel. In the Lake Superior district the shaft-houses
have in connection rock-houses, where the preliminary crushing is
In hoisting with a bucket this swings free in a vertical shaft, while
incline shaft the bucket rides skids, or, preferably, a trolley cable.
esent maximum capacity of skips and cages is about twelve tons of
In deep shafts the weight of a skip or cage and the cable attached
is fully equal to the weight of the load hoisted, but by working in
balance the disadvantage of these excessive weights is reduced
. Hoisting is done mainly by steel cables, composed of strands, each
p of numerous steel wires, slightly twisted. In some districts flat
ables are used. Cables should be inspected at regular and frequent
ls, and all defective ropes removed, as the constant strain of torsion
he strength of the best of cables in time. Care should be exercised
venting short turns, as these are very damaging to the life of the
Large sheaves and drums of large diameter, with minimum changes
ction, add greatly to the life and safety of steel cables. The engine-
containing the hoists almost invariably are set on the footwalls of
ines, partly for safety and partly to obviate short bends in the
g cables.

shallow mines the workmen go up and down on the ladderways,
in deep mines the men ride in the cages of the vertical shaft, or in
e of incline shafts, ride to and from their work in skips, or, in some
on man-cars especially built for carrying mine-workers. The old
f man-engine, which was highly efficient in its day, has gone out of

competent engineer is as necessary to a mine as to a railroad, and
aps are equally important. While a competent civil engineer can do
rk in mine surveying, and some excellent mining men have had

chemist and engineer, and possibly also bookkeeper and supply clerk, and there are cases on record where to these accomplishments the mine manager added the blacksmith's trade as well, but that is almost too much talent for one man to possess. The records of old mines usually are deficient in reliable maps, but modern practice is very thorough as to engineering and mapping, and blueprints are extended monthly, from accurate data obtained underground.

While the general public uses the term miners for all underground workmen, this term is reserved in actual practice for the skilled workmen who do the drilling and blasting. Mine timbering is skilled work that is done sometimes by the miners, and sometimes by special timber gangs. The muckers, or trammers, are the men who do the shovelling and rough labor of the mine. Some large properties have special shot-firers for blasting. Miners may work by the day or on contract, contracts being divided into two general classes, the first being opening work, which consists mainly of shaft-sinking and running drifts. The second class of contract work is stoping, the latter being the actual breaking down and extraction of ore in considerable quantities. Contract work is preferable in nearly every case where possible, and gives more satisfactory results to both miners and mine-owners, as it secures more work to the owners for the money paid, and also gives larger earnings to the good workmen. In the case of contract miners the supplies furnished by the mine, such as candles, detonators, fuse, dynamite, etc., usually are charged at much more than cost, such prices sometimes running two or three times the actual cost to the mine. On the face of it this practice is a great injustice to the miners, but in actual work is defensible on the ground of results. It has been shown by actual trial that the average contract miner is careful or careless of supplies in proportion to their cost, and as the excessive use of supplies is a dead loss that eventually must be shared between the miners and the owners, anything that operates to bring about economy is an advantage to both parties.

Most copper mines work two or three shifts. The double shift mines usually work shifts of ten hours each, but in mines giving the eight-hour day it is customary to work three shifts, thus utilizing the entire twenty-four hours. There is economy in keeping underground work going at top speed, with double or triple shifts, the fixed charges and many of the heavy expenses on surface being the same in either case.

Mining, at best, is a dangerous calling, and when not surrounded by proper safeguards is extra hazardous. The copper mines make a good showing among the metalliferous mines of the world, in their proportion of fatalities, and in the leading districts the precautions taken result in keeping down the percentage of mortality to a fairly low basis. The principal cause of accidents, responsible for more than half of all the deaths, is the carelessness of the miners themselves. Human nature is so constituted that the average man becomes habituated to danger that is met with in the course of his daily work, and miners fall into shafts and winzes, or step from stagings through sheer carelessness. Of the semi-avoidable sources of accidents, falling ground is responsible for more than half the deaths. This source of trouble is called semi-avoidable for the reason that, with care, accidents from this cause can be greatly reduced, though not

entirely eliminated by even the utmost vigilance on the part of both men and management. Missed holes or premature explosions are responsible for many horrible accidents and deaths. Poor fuse is more dangerous to miners than dynamite, and wise managers scrutinize the quality of their fuse as closely as they investigate the safety of their hoisting cables. Accidents through riding in skips are unpleasantly common. In many mines there is a rule that miners shall not ride to or from their work in skips, but this rule seems made to be broken, and serves merely as an excuse to the management when accidents occur. It is much better to shoulder the responsibility, as many managements have done, and permit the men to ride in the skips with such safeguards as can be furnished.

Ankylostomiasis, or the hook-worm disease, is found in but few copper mines, but seems to be spreading, and should be guarded against. The spread of this disease is greatly facilitated by dampness.

The methods by which ore is extracted vary greatly, the principal factors determining the method to be used being the nature and size of the ore deposits, and the character of the walls. Most mines are irregular as to both the size and value of their ore bodies, which vary from point to point, in dip, strike and tenor, and the walls of ore bodies frequently are poorly defined. Sometimes there is a selvage of fluccan, very soft clayey material, along either or both walls. Faults are noted frequently, and the ore body may be thrown in any direction by a fault, or series of faults, or may be cut out temporaily by a dyke, or may be divided by a horse, or may come to a final end against a different formation. In other cases the ore body may continue as a vein, while losing its mineral values when passing into a different country rock. Veins also fork and come together. Superincumbent strata are apt to creep, especially in a limestone formation, on a mountain side where the strata are deeply tilted, such mines requiring heavy timbering and constant care. Heavy pillars of vein rock usually are left standing beside the shafts, and sometimes elsewhere in the mine, as supports for the rock above. When a mine is considered worked out it is customary to rob the ore from the pillars and permit the mine to cave in, but sometimes nature caves in the mine before the owners get around to the job.

By the caving system of mining superincumbent rock and drift are permitted to fall into the mine, a litle at a time, the process being practically continuous. The shafts are protected by heavy pillars, or, preferably, are sunk in the solid footwall and the ore body reached by crosscuts. Mining is begun on the top level, which is timbered lightly, being secured just enough to permit the safe extraction of ore values. While stoping is in progress on the upper level, drifts are being run on the level below, and a plat cut from the shaft for a third level. The various levels are stoped in order, from the top down, no reserves being left in the levels that are stoped, as these begin caving almost as soon as the work of stoping is finished, and sometimes before. In a mine worked on the caving system the stoped out levels above are constantly coming in, and the miners at all times are working under caving ground. Notwithstanding the apparent danger of this plan, the mines worked on the caving system average fully as safe as those worked by the older methods, and the plan has decided advantages for many mines. It is not, however, adapted to all mines, and

a modified system, in use at a few properties, bids fair to increase, especially in the Lake Superior district, where some of the older and deeper mines are experiencing much trouble from air-blasts and similar troublesome phenomena coincident with very deep mining. This modified plan of the caving system calls for the sinking of shafts, preferably in the solid footwall, and drifting on each level to the extreme length of the territory to be exploited. A seven-by-seven drift, well timbered, is too small an opening to seriously endanger caving. Stoping is begun on the top level, at the extreme end of the drift, and stopes are timbered but lightly, stoping working backward toward the shaft, and the ground is permitted to cave behind the miners. By this plan of mining stoping must begin on the upper levels, and continue in steady order toward the bottom of the mine. This plan is thoroughly sound in theory, and, while not in general use, seems certain to grow in popularity, and to give satisfactory results in mines that would be dangerous to work on the old plan.

Ore is blocked out when it has been opened on three sides, and ore in sight, strictly speaking, is ore that has been blocked out, but this term is sadly misused, in many cases, and incidences are not lacking where small mining companies, with stock for sale, have claimed millions of tons of ore in sight, on the strength of a fair outcrop on the surface and a hundred feet or so of shaft or tunnel.

Timbering may be of wood, rock or concrete, but as a rule is of wood. The increasing scarcity of good timber, with consequent rise in price, in most parts of the world where copper mining is followed extensively, is causing vigilant mine managers to utilize other material to an increasing extent. The use of concrete and cement has reached the highest point in Germany, but is gaining ground in the mining fields of many other countries. Timbering may be heavy or light, according to circumstances. Some copper mines, like the Calumet & Hecla and Copper Queen, are forests of timbers, while others, like the Osceola, have but very little timber outside of that required for skip-roads and ladderways in the shafts. Heavy timbering is required from surface to the solid rock ledge, when passing through alluvium. There are many different methods of timbering with wood, but the one in most general use and favor is known as the square set system. A square set of timber has a bed-piece, two legs and cap of the same length, usually eight feet, mortised and tennoned. A similar set at eight feet distance is connected with bed-pieces and caps, and these cubicles may be extended indefinitely in any direction. Lagging usually is placed above the cap-pieces of a square set to prevent the falling in of rock from the roof, and in soft ground bulkheading is required, this necessitating the driving of heavy sticks of 8-foot timber into the ground on either side, to form a solid bulkhead. False sets are used at times, and sprags are utilized frequently. The use of dry-walling is increasing. Dry-walls are built of waste mine-rock, laid without mortar, and when carefully built are very effective in holding the ground above, and have the advantage of disposing of waste rock that otherwise must be hoisted. Ore is anything that will pay to extract for its metallic values, and varies greatly in different fields, and under different circumstances. In some of the Lake Superior mines rock carrying an average of one per cent. copper pays millions in dividends, and rock carrying even one-half of one per cent.

metallic copper is treated at some properties, though the average of the mine necessarily is higher. In other fields ores that carry ten per cent. copper are unprofitable, because of narrow veins, lack of transportation or other serious drawbacks. In Australia the soft mullock broken in the mines is used for filling in cribs, by what is known as the pig-sty system. Concrete seems especially useful for finishing the collars of shafts, and has been tried for the sleepers of skip-tracks, but seems somewhat rigid for the latter use. Courses of brick have been used for finishing the collars of shafts in the Lake Superior district. Steel, mainly in the form of worn-out rails, cut down to short lengths, is used to a considerable extent for timbering in some mines. There is no question that concrete must be used to an increasing extent in mine timbering.

The matter of disposing of water is a problem of importance with most mines. Tunnel drainage is possible with properties opened exclusively above the adit level, and, with mines partly opened by shafts and partly by adits, the water is discharged through the lowest tunnel level. Occasionally large vugs are encountered underground, and small mines have been flooded from the waters contained in such cavities. Limestone, so often met with in copper mines, is readily permeable by water, and one mine may drain an entire basin of considerable area. Good mines are lost sometimes because of the excessive cost of keeping them free of water.

Where a mine must be kept unwatered otherwise than by natural drainage through adits or tunnels, the water may be removed by pumping or bailing. Mine pumps may be divided into two classes, these being movable and stationary. Station pumps usually are of large capacity, and are set permanently in underground stations prepared for them, while sinking pumps are placed on skids and lowered in the shafts by chains or steel cables as required. The great majority of both station pumps and sinking pumps are actuated by steam or compressed air, usually the latter, though steam may be used in shallow mines before the installation of air compression plants, or in a great emergency, but the carrying of steam to a considerable depth is impracticable, owing to excessive condensation. Electric pumps are increasing in numbers and efficiency, and with further improvements should prove the ideal variety of pump for most underground uses. Air-lifts and pulsometers are used to some extent, mainly for sinking purposes. Water also may be removed from mines that have filled through idleness or that have been flooded accidently, by bailing. The bailers, which replace buckets, cages or skips, usually are large cylindrical tanks, frequently old steam boilers, with a valve bottom, and, at a pinch, ordinary skips may be used. The method of unwatering mines by bailing is used only in emergencies, though some attempts have been made at utilizing bailing for regular mine drainage.

All mines show an increase of temperature with depth, after the first few hundred feet of the earth's crust is penetrated, but the rock temperature varies greatly in different fields. The Lake Superior copper mines, which are the deepest of any mines in the world, are not so hot at similar depths as the mines of most other fields. At the vertical depth of 4,920 feet the rock temperature in the Red Jacket shaft of the Calumet & Hecla was 87.6° Fahrenheit, but this has been reduced, by connection of the

lower levels with other shafts, and by the utilization of compressed air exhaust from the rock-drills. Many sulphide ore mines are extremely hot, owing to the gradual oxidation of sulphur.

Copper mines contain neither choke-damp nor fire-damp, those deadly gases found in coal mines, but nitrous oxide fumes from dynamite are poisonous, and are difficult to dissipate in workings having only one open end. Powerful fans at surface sometimes aid in ventilating the dead workings of deep single shafts. The general use of power-drills, actuated by compressed air, assists materially, not only in furnishing fresh air in dead workings, but also in reducing the temperature in deep mines, as air yields up considerable latent heat when compressed, and robs all surrounding objects of heat when released from compression. In mines of more than a few hundred feet in depth nature provides a system of ventilation as soon as two shafts are connected underground, the shallower shaft becoming a downcast, through which the air is sucked down, with great force, while the deeper shaft—that is the one having its collar on the highest ground at surface—becomes an upcast. The deeper the shaft the stronger the draft, for the same reason that a high chimney gives a stronger draft than a low one. In deep shafts the air currents so called into being are so strong that it is necessary to provide air-doors in the connecting levels.

Fire is a danger to which practically all mines are subject. Even a fire on surface may endanger underground workmen, through the destruction of the hoisting plant, or headgear, and fire from a structure over the shaft may enter the mine by working down the timbering. Underground fires may be divided into two classes, the first occuring in sulphide mines where the ore itself furnishes the fuel, while the other class occurs in mines with heavy timbering that is liable to burn. Heavy damage to a mine, accompanied by serious loss of life, may occur through either form of fire. Timber fires are caused mainly by the carelessness of miners in disposing of candle-ends, lamp-wicks, matches and partially burned tobacco from pipes.

In the Calumet & Hecla mine, which has suffered losses aggregating millions of dollars through five serious mine fires in the past quarter century, great precautions are taken, not only to prevent the occurrence of fires, but to put out mine fires immediately after their inception, and to prevent the spreading of fire throughout the mines. Masonry bulkheads, fitted with fire-doors, permit the cutting off of different portions of the mine. Electric signals and telephones furnish the means for turning in prompt alarms, and water-pipes and fire-hose are kept at underground stations for the fighting of fires that have gained a foothold.

All mines containing large bodies of ore rich in sulphur are liable to spontaneous combustion, but this danger can be minimized by various precautions, thongh not obviated entirely. The danger of spontaneous combustion is enhanced by the fissuring caused by improper support of ground opened or stoped, as such fissuring produces considerable quantities of pulverized sulphides that are subject to unusually rapid oxidation, and are liable to spontaneous combustion. The St. Lawrence mine, at Butte, Montana, has been on fire for nearly a score of years. There also have been serious fires in the United Verde, Iron Mountain, Wallaroo & Moonta and

other sulphide copper mines. A sulphide mine fire, while dangerous and costly, has the advantage of not destroying values to a large extent, as the copper contained in the ore is leached readily by the natural drainage of the mine, after the burning of part of the sulphur from the ore, and the values can be gained as cement copper on surface, by precipitation from the heavily charged mine waters. A mine fire may be drowned by water, or extinguished by shutting off the supply of oxygen. Carbon dioxide, which is heaver than air, also has been pumped into mines to extinguish flames. This can be generated in large quantites, in old boilers, by treating crushed limestone with dilute surphuric acid, but the process is slow. Perhaps the most successful method yet used in fighting a sulphide mine fire was devised in 1906, at the Iron Mountain mine, in California, where an exhaust ventilating fan was reversed, and used as a blower. The air-current from the blower drove the sulphurous acid gas, given off from the burning stopes, back into the broken ore, thus enabling the miners to remove the face of the ore on fire, ore being mined at temperatures of 160° to 450° Fahrenheit. This plan called for a very careful balance of air pressure, in order to clear the mine workings of foul gases to such an extent as to permit work to be carried on, while insufficient to fan the flames in the fissured ground unmined.

Air-blasts, noted in some of the older Lake Superior mines, are artificial earthquakes, caused in the older and deeper mines by the slipping of superincumbent strata insufficiently supported by mine pillars. One of these air-blasts, in 1906, was of sufficient severity to cause an earthquake that was felt over an area of some thousands of square miles. The liability of mines to this trouble increases with their age and depth. The first symptom of air-blasts usually is given by the violent decrepitation of small particles of rock from pillars that are subjected to excessive strains. Small masses of rock are thrown off violently, with detonations like pistol shots. Such troubles, when once begun, are liable to prove continuous and cumulative.

The lighting of copper mines is mainly by candles or lamps, the fuel in either case being stearic acid as a rule. Electric lights have been tried, but were not liked, the illumination being too powerful, and rendering the miners nervous by giving the roofs the appearance of danger, where careful inspection by the light of lamps or candles showed the ground to be perfectly safe.

The old system of mine signalling was limited to a single heavy wire, running down the shaft and connecting with a bell in the engine-room, which was rung by pulling levers attached to the wire, at the different levels of the mine. Electric signals are now in quite general use, in most mines of importance and telephone systems have been installed in many mines, while a beginning has been made in the use of electric signalling systems displaying semaphore arms and colored lights.

In the actual breaking and removal of rock or ore, the first step is that of drilling holes for explosives. In mines carrying ore in a decomposed talcose gangue it is possible to drill holes by hand, with a breast-auger, but in ordinary rock and ore, holes must be bored with steel drills. Such drills are of varying lengths, and are changed from time to time, as the hole is deepened. There is a considerable variety of cutting faces for

drills, but that in most common use has two cutting faces crossed at right angles. Drills are dulled rapidly, and require frequent sharpening, for which purpose they must be taken to the smithy, on surface. Hand drilling has given way in most properties to power drilling, the machines being actuated by compressed air or electricity, the former agent being in very general use in most important mines. The water-drill is a form of drill, actuated by compressed air, in which a jet of water is fed through a hole in the centre of the steel bit, to lay the dust produced by the drill. The power drill is fixed on a tripod or pillar, to afford solidity, and power drills are worked frequently on timber stagings and rock ledges that would seem inaccessible to anyone but an experienced miner. Electric drills have given unsatisfactory results in many mines where tried, though working excellently in a few properties. The trouble with electric drills is due, probably, to inefficient designing in some makes, and to even a larger extent to inefficient handling, rather than to any inherent defect in the theory of the machine. A set of holes for one blast is known as a round. Much skill is shown by old miners in drilling such holes, which must be driven at such angles, to such depth, and in such number as to break the proper amount of rock with a minimum expenditure of labor in drilling, and with a minimum charge of dynamite for blasting. A skilled miner, who takes full advantage of cleavage, jointing and bedding planes, of varying strengths of different rock forms, and of fundamental principles of physics, will accomplish better results, with half the drilling and half the powder, than can be secured by a beginner or an ignoramus.

Ordinary gunpowder, commonly known to miners as black powder, is useful for blockholing, which is breaking up large masses of rock previously broken, and occasionally for other uses, but dynamite is the principal underground explosive. This consists of nitro-glycerine, taken up by some absorbent, usually wood-pulp, sawdust or diatomaceous earth. The strength of dynamite varies greatly, and should be gauged according to the nature of the rock. Some of the newer high explosives are used also, to a limited extent, in copper mines. In blasting, the dynamite cartridges, which slip easily into the holes bored for them, are placed at the bottom of the holes, in such quantities as required, and in the pasty top of the final cartridge is inserted a copper cap or detonator, holding a single drop of fulminate of mercury, with the end of a fuse firmly fixed within the end of the cap. The fuse is fired by a match or candle, it being timed by the length to which it is cut, and when the fire in the core of the fuse reaches the fulminate of mercury there is a sharp explosion, which in turn explodes the dynamite. Occasionally charges of dynamite fail to explode, and as a round of holes consist of five to a dozen borings, the dynamite in one or two holes may fail to explode. Such missed holes are highly dangerous, and frequently cause explosions later, when the dynamite is reached by the drill in boring other holes. When a mine is worked with a ten-hour shift, blasting is done twice per shift, as a rule, the blasting being timed at about a quarter-hour before the close of the half shift and full shift, thus providing an hour and a quarter for the dynamite fumes to dissipate from the workings. Dynamite, fuse and detonators usually are kept underground in boxes, sometimes in large quantities, and carelessness in handling is responsible for very serious accidents at times.

When broken, the ore, or rock, or both must be disposed of, usually by hoisting both ore and worthless rock to surface, except where underground selection is possible, in case waste-rock is used for dry-walling or fills. In the old system of mining the long-handled shovels in the hands of muckers were the main reliance, ore and rock being loaded into tramcars of wood or steel, which were pushed from the face of the workings to the shaft on light T-rails or strap-rails. In modern practice rock frequently is sent down, through chutes, to bins on the level below the one where broken. The chutes may be of wood or iron, and chutes built of rock are used in some mines. Broken ore or rock usually will clear itself in a chute of 30° to 35° dip, and even with less dip in the case of an iron chute.

Underground haulage plants are used in a number of the larger and more progressive mines, though this system is suitable only to properties that have long hauls, and large ore bodies on the levels where such haulage plants are installed. Underground tramming by power is done by locomotives, actuated by compressed air or electricity, steam locomotives not being suitable, owing to the confined scope of operations, where smoke and gases from the boiler would poison the underground atmosphere. Underground loading-bins are coming into use, and these, which are installed at the shaft, on the various operating levels, permit the trammers to discharge their cars into the bins, and skips can be filled from the chutes of the bins as required. This system obviates delays both in tramming and hoisting, and has much to commend it. A hoisting system installed recently at the Wolverine mine provides for special workmen known as car-dumpers. The trammers leave loaded cars at the shafts, and the dumpers discharge these into the skips, beginning at the top hoisting level, and working down, level by level, to the bottom, then riding up in the skips and beginning anew. In sinking deep winzes the shovel is the main reliance in disposing of ore or rock, which must be shoveled up from stage to stage, in the most laborious manner, unless a donkey-hoist is installed to care for the dirt. For this reason upraises are preferable to sinking, in the opening of winzes, as a rule.

In early days the heavy mass copper of Lake Superior mines, ranging in weight from a ton to 500 tons per mass, was cut up into chunks not too heavy for hoisting, by the use of long-handled chisels, this process being laborious, slow and costly. The work of cutting up masses underground is now done with pneumatic chisels, at about a tithe of the former cost.

The span of life of any mine is a matter of vital importance to its owners, but no general rule can be given for gauging the life of copper mines, as each property is a problem with varying factors that must be worked out individually. The Rio Tinto is the oldest active mine of the world, and until the discovery of the monzonite-porphyry ore bodies at Bingham, had the largest proven ore reserves of any mine of any metal, notwithstanding its having been worked for some three thousand years. The Lake Superior copper mines, operating on stratified beds, will hold indefinitely in depth, but the depth to which successful mining may be done cannot be predicted with any degree of certainty.

CHAPTER V.

The Milling and Concentration of Copper.

As native copper and copper ores usually occur disseminated in gangue rock, the first process of reduction after the ore is brought from the mine is one of concentration. Milling really should begin in the mine, and a little care on the part of the mine superintendent often eases the burden of the mill superintendent and brings about cheaper and closer extraction. The use of excessive charges of dynamite in blasting not only is a waste of explosives, but results also in the making of an unnecessary quantity of fines, causing an excess of slimes in the mill, with consequent labor and expense in extraction, and unnecesarily heavy losses. The mine superintendent also can aid the millman greatly by sending with his ore the minimum quantity of wood, drill-steel, hammer-heads and other material that is rather unpleasantly common in the average ore that reaches the average mill.

The general principles of milling are the same in the concentration of all ores, but local practice varies greatly, according to the nature of the ores of various districts. The practice in general use in the native copper mines of Lake Superior is given at the end of this chapter.

Mills usually are built as near the mines as possible, to save long hauls on ore, and frequently are located immediately at the mines, though at times it is necessary to build the mills at some distance from the workings in order to secure adequate water supply. As a rule mills are located in mountainous districts, where full advantage can be taken of the steep slopes, and modern mills are so planned and constructed that the raw ore is dumped into bins at the top of the structures, and passed gradually through the various processes, the final concentrates being discharged on the lowest terrace, thus taking full advantage of gravity. The elevation of material, once common in all mills, is reduced to a minimum in modern plants, which are nearly automatic, and require much smaller forces of workmen, who, as a rule, are skilled men that understand why as well as how. In most cases a ready-made mill is a serious mistake—the same sort of a mistake that would be made by the laying out of shafts and drifts for a mine by engineers who never had seen the property. Every mine has individual problems that can be solved satisfactorily only by the man on the ground, if he be a competent miner, and the same observation holds as true of the milling as of the mining, at most properties. Much of the trouble in mill practice arises from faulty designing, often where good mill men, either technical or practical, or both, plan mills to treat ores from an unfamiliar district. Local peculiarities require local adjustment in milling practice, and it frequently is the case that what is the best practice for the milling of ore from one mine is not exactly suitable for the milling of ore from even an adjacent property. This matter of local variations is one that cannot be treated except in the broadest outline, or in the fullest detail. The best modern mills are now designed, with great care, to treat the specific ore of an individual property, and careful de-

signers frequently make extended mill-tests, and other experiments, before designing either the structure or equipment of a mill. As a result of this care, losses have been greatly reduced at the best mills, and tailings now run nearly as clean as the slags from a well managed smelter.

There is a general haziness regarding the matter of rating milling capacity. It would be well if this could be removed, and that it should come to be clearly understood that a 100-ton mill was designed and equipped to treat advantageously 100 tons of material daily, and that any considerable excess over this quantity of ore, while it might be run through, could not be handled so as to secure thoroughly satisfactory extraction. The average designer is apt to underrate the capacity of his mill, probably under the mistaken impression that a mill rated at 100 tons that proves capable of treating 125 tons satisfactorily is a credit to his professional reputation. The best results never are secured from any machinery that is run to the fullest limit of its capacity. In many cases a hundred-ton mill may be made to put through 150 tons of material, but the work will be slighted at nearly every stage, and the losses will be correspondingly heavy.

Too much stress cannot be laid upon the practical coördination of every process in the mill. Each particular department should have sufficient capacity to handle, to advantage, its due proportion of material, this capacity necessarily decreasing toward the end, as the ore becomes concentrated, and an increasingly large amount of gangue has been eliminated.

Occasionally there arise difficult problems in handling materials of widely varying specific gravity. As a case there may be cited the Shannon mill, in Arizona, which treats ores have the following specific gravities: chrysocolla, 2; azurite, 3.5 to 3.8; malachite, 3.7 to 4; chalcopyrite, 4.1 to 4.3; chalcocite, 5.3, and cuprite, 5.8 to 6.1, while the specific gravity of the quartz gangue is 2.64. While this is an extreme case, it is by no means uncommon for a mill to treat ores of two or three widely varying gravities. It is now possible to handle successfully mixed ores that were worthless even as recently as the close of the Nineteenth Century, because of the impossibility of satisfactory separation. Zinc, especially, is removed from copper ores much more readily than formerly.

In the concentration of ores, hand work is used exclusively at some of the smaller mines that are distant from smelters, where the ores must be brought to a high copper tenor by hand selection. Even in the case of mines having good mills, a limited amount of hand selection may be used to advantage, and hand-cobbing, by which worthless gangue rock is separated from valuable ore, may relieve the mill of considerable work. Many mills have picking-tables or picking-belts. The best form of picking belt is one that carries the material past the workmen, who remove the valuable ore for further treatment, while the worthless material remains on the belt and is dumped automatically at the end, or vice versa. Magnetic separation is used, with success, in a number of copper mills, where the material to be removed is magnetic, or can be made magnetic by roasting.

For almost every milling operation there is a choice of machinery, or process, or both, and advocates of these different processes or devices usually are loud in the praises of their pets. While some machines are better adapted than others to certain uses, more depends upon the entire milling system being planned with a view to treatment of the particular ore

handled, and the intelligent carrying out of the theory into practice, than upon the make of the machine that is employed, though this is by no means unimportant. A good millman will secure fair results from indifferent machinery, while an inefficient millman will obtain poor results from good machinery, either through poor grouping or inefficient handling. Only the man on the ground, and he only after repeated experiments, can intelligently adjust even a good mill to fully satisfactory work.

Owing to scarcity of water in many copper mining districts, where it must be used and husbanded with great care, settling ponds are provided, and some great economies are effected, not only in repeated usings of the water, after clarification, but also in minimizing the gross amount of water required for milling ore. The Detroit mill, at Clifton, Arizona, makes extensive use of settlers, and requires only about 300 gallons of fresh water per ton of ore treated.

Large storage-bins for ore are of much advantage to a mill, and the disadvantage of small storage-bins becomes apparent, shortly, to the superintendent of every mill that is so unfortunate as to have them. Large storage capacity for raw ore affords a balance wheel, and takes up slack that otherwise results in occasional mill stoppages, due to temporary mine stoppages, or even to a decrease in the day's output of the mine. Large storage capacity for concentrates is desirable also, in some cases, though not so important as storage capacity for raw ore.

Modern milling practice pays greater attention than formerly to both extremes, beginning with the coarse concentrates and ending with the slimes, and the classification of ore is carried out far more thoroughly than formerly. The advantage of removing concentrates as coarse as possible is that by so doing extensive sliming is obviated. At every operation by which ore is reduced in size, slimes are produced. Some ores slime much more readily than others, according to their structures, but all ores are more or less susceptible to sliming, and sliming easily can be carried to excess by poorly devised milling processes.

Crushing may be done either wet or dry. Where dry crushing is in use a great deal of fine dust gets into the air, and this should be removed by an exhaust fan. On very heavy material it is advisable to divide the crushing into two, and possibly three, operations, as no jaw-crusher can break masses of rock or ore to minimum size advantageously. Crushers are of many makes, but are essentially of two classes, one being the jaw-crusher and the other the gyratory crusher. There is a difference of opinion as to which causes the most sliming, but it is probable that a smaller percentage of slimes is caused by gyratory crushing, in most cases. The jaw-crusher is in more general use, however, than the gyratory. Rolls are used to a considerable extent in milling copper ores, but are not employed so generally as in the reduction of lead and zinc ores.

It is advisable to use a grizzly or trommel between each process of reduction, and the use of a grizzly before the first crushing will remove a considerable percentage of fines from average ore. The intelligent use of grizzlies or trommels not only obviates excessive sliming, but also saves the labor and power that otherwise would be used in unnecessary crushing of fine material. Revolving screens or trommels are of different styles and makes. These usually are of the same diameter throughout, but occasion-

ally are built tapering, though the uniform size seems more satisfactory, as a rule. The material delivered to such screens is carried to the lower end of the trommel by gravity, aided by the rotary motion of the screen. The openings in the screen, through which ore falls, may be of uniform size, from end to end, or may be divided into two or even three sizes of openings, giving the same number of sizes of concentrates. More inclination is required on coarse material than on fine, and more in dry screening than wet. Revolving trommels will handle ore satisfactorily down to particles of two to three millimeters in size, and impact screens will do good work on lumps of ore as small as one millimeter in size. Perforated metal is preferable to woven wire for screens, as the perforations are very slow in wearing, while the woven wire is quite certain to give openings of irregular dimensions after the screen has been used for a short time.

After crushing the ore is passed over jigs, of which there are a great many different designs, though the essential principle is the same in all, the gangue, which is lighter than the ore, being driven off by rapid oscillatory or vibratory movements of the bed of the jig, aided by the force of running water, the vibration and water jets being so carefully regulated as to permit the ore to remain on the bed of the jig while the worthless gangue rock is washed away. No matter how carefully this work may be done a little ore is lost in the tailings and a little rock remains with the concentrates . The Hancock jig has the greatest capacity of any make, and its use is increasing outside of Australia, where it was invented. While not suited to all grades of ore, there are many copper ores on which it can be used to advantage. The jigs usually are worked in series, and are divided for the handling of two or three different sizes of material, these being known as roughing jigs, middling jigs and finishing jigs, or having other names, according to different local usages, for the coarse ore, middlings or raggings, and fines. There is much more regrinding of both middlings and tailings than formerly, and there is much better machinery available for this purpose than even a few years ago.

The treatment of slimes varies greatly, in different mills, but, as a rule, the slimes are put over patented concentrators or tables, of which the Wilfley seems the most effective and in most general use. The Wilfley grades the fine ores and separates them from the finely crushed gangue rock by means of an inclined table having riffles covering about one-half of the surface, these being arranged along a diagonal line from corner to corner, the table having a slight oscillatory movement. Circular tables also are used to some extent. Screen sizing usually is stopped at about three millimeters, and hydraulic sizing begun. This is very effective, in most cases, but is not suitable for fine slimes that already contain an excess of ore, these requiring settling tanks. There is one make of hydraulic classifier, of considerable promise, that utilizes air-jets in connection with water. Hydraulic classifiers are of considerable variety in form, but usually have "V" or "W" shaped bottoms, whence the settled fines are drawn off, through plugs, for further treatment. Slime tanks also are in use in many mills for the final collection of fines. Filter presses are used but slightly for copper milling, though in common use in many gold mills. One of the greatest advances made in milling practice, since the beginning of the century, lies in the far greater saving of slimes, as compared with the older practice.

In the matter of sampling, the old and highly inefficient rule-of-thumb

plan has been discarded, in all modern mills. There are several excellent makes of automatic samplers, that do very accurate work, but, of course, these samples must be assayed both honestly and carefully in order to take advantage of the information that they offer regarding losses in tailings. It is probable that the losses in tailings in old mills were considerably greater than ever were shown by the grab-samples taken under the old methods.

The fines and slimes from the mill are finely comminuted, hence usually require briquetting before smelting, as otherwise a large proportion would be blown out of the furnace as flue-dust. A small quantity of lime, or some other suitable material, may be used for a binder, in briquetting, but this is not necessary in all cases, and in some instances fines and slimes from the mill are briquetted in connection with flue-dust from the smelter, preliminary to furnace treatment.

Oil concentration has been experimented with extensively, but is not yet fully accepted in milling practice, though some excellent results have been secured. In nearly every instance where oil concentration has been carefully tested, the technical results have been very satisfactory, but in many cases the process has not proven commercially available. Given a fairly steady and copious supply of material suitable for oil concentration, there seems no sound reason why the process should not prove a commercial success. There are several processes of oil concentration, but the original and most important is the Elmore system. By this process the ore is first pulped, then passed through a horizontal rotary drum, provided with cross-blades that lift and drop the pulp while propelling it along the drum. With the pulp is admitted a small quantity of viscous oil, left as a residue from the refining of petroleum. This oil, which is the best for the purpose, and also possesses the advantage of cheapness, selects the ore while rejecting the gangue rock. The oiled pulp is discharged, automatically, into spitzkasten, in which the tailings of gangue rock settle down and flow off, while the oil containing the fine ore floats and is drawn off from the top of the spitzkasten, into a centrifugal extractor that removes the oil, which is again used, the loss of oil in the process being quite small.

Various forms of pneumatic concentrators have been devised, from time to time, but none seem to have scored a marked success, though the theory seems good, and pneumatic concentration may become a success, eventually.

Electric concentration has been attempted, at various times and in various ways. The most promising of the electric processes, to date, provides for the utilization of static electricity. Finely crushed ore and gangue come into contact with a metallic surface, charged statically, which repels the particles of high conductivity, while those of low conductivity are retained for a sufficient length of time to be drawn aside and discharged into a separate receptacle. This process, while it does not appear to have come into use, would seem to possess intrinsic merit, for the separation of mixed ores of chalcopyrite, sphalerite and galena, which are of such common occurrence, intimately intermixed, in many fields.

In the Lake Superior district, where copper is found native, the milling process differs somewhat from any in use elsewhere, the principal feature of difference being in the crushing of ore by steam stamps. The native

metal occurs mainly disseminated in small particles through amygdaloidal or conglomerate rock, in quantities averaging only 15 to 30 pounds of copper to the short ton of rock in the amygdaloid mines, and averaging only 45 pounds of copper in the richest conglomerate mine. The metal sometimes occurs in masses that weigh from a few pounds up to hundreds of tons each. The larger masses are cut underground into pieces sizeable for hoisting, and when arrived at surface, are hand-cobbed, to eliminate as much as possible of the adhering gangue, and then put directly into the reverberatory furnaces for smelting.

The preliminary work of a stamp-mill, in the Lake Superior district, is done in the rock-house at the mine. This usually is built in connection with the shafthouse, though one rock-house may care for the production of two shafts. The ore is dumped from the skips, or cages, onto the upper floor of the rock-house, where the small masses are cobbed under steam-hammers, and the balance of the ore, containing fine copper disseminated through gangue rock, is passed over a grizzly, the larger masses going through a powerful jaw-crusher, the product of which descends to the next floor and there is put through smaller crushers, going thence to bins, from whence it is drawn into railroad cars and taken to the stamp-mills.

The modern stamp-mills are of fireproof construction, having steel frames, with cement floors, and are liberally supplied with windows for lighting. The buildings are terraced, so as to take full alvantage of gravity in handling the material treated. The storage bins at the tops of the mills, are connected with trestles, which permit the access of loaded trains, and the bins are of great capacity, holding thousands of tons of rock in the larger mills. Picking-belts are used to some extent in some of the mills.

The first stamps in the mills of the Lake Superior district were of the old Cornish style, crushing by gravity alone. The Ball head is a single stamp, operated by steam, and the entire stamp, including mortar-box, is one machine, set upon a very heavy foundation. Formerly heavy timbers were placed between the foundation and the mortar-box to furnish vibration, but these were found undesirable, and the practice has been discontinued. The ordinary steam-stamp has a piston of 18 to 20 inches diameter, with stroke of about 24 inches, the piston developing a velocity of about 25 feet per second and striking blows of three to four tons, at the rate of 90 to 110 strokes per minute, under a steam pressure of 95 to 120 pounds per inch, in the case of the simple heads, which are driven by engines of 150 to 250 horse-power each. The weight of the reciprocating parts of a steam stamp averages about 5,500 pounds. The economy in steam consumption possible through compounding the simple stamps being readily apparent, cross-compounding was tested thoroughly at the Champion mill for about a year. The results proved a large economy in steam consumption, but the very considerable disadvantages inherent in working four 500-ton stamps as a unit proved too great, and the system was abandoned. The cross-compound stamp was followed by the Nordberg steeple-compound stamp. This has high and low pressure cylinders, mounted tandem one above the other, and in actual practice the steeple-compound stamp has given an increased capacity averaging about 25 per cent., with a saving of about 25 per cent. in fuel. At the beginning of the last decade of the

Nineteenth Century the average crushing capacity of the simple steam-stamp in the Lake Superior district was 350 tons per 24 hours. This has been increased by heavier parts, greater power and the discarding of timber foundations, to 500 and even 600 tons per diem. The steeple-compound stamp is of much greater capacity, one stamp in the Osceola mill having crushed 779 tons of amygdaloid rock in 24 hours, in 1906, with an average for two weeks of 600 tons per day, including all stops. The capacity of the stamps varies considerably, at the different mills, according to the nature of the rock crushed. The conglomerate rock of the Calumet & Hecla is much more refractory than the amygdaloidal rocks of the other mines, and a stamp can treat only 60 to 65 per cent. as much conglomerate as amygdaloidal rock. The conglomerate also is much harder upon stamp-shoes than the amygdaloid. These shoes are of chilled iron, cast by local foundries, which are able to give an 11-inch chill, a statement that may be doubted, but is susceptible of full verification. The shoes weigh about 800 pounds each when cast, but lose half of their weight and become badly worn in four to fourteen days, according to the nature of the rock crushed, and are then discarded. Rock is fed under the stamps in pieces ranging up to a foot or fifteen inches in extreme dimension, with a smallest dimension of about four to six inches.

The system of coarse stamping now in general use was begun at the end of the Nineteenth Century. This process utilizes mortar-grates for discharge having perforations of about ten-sixteenths inch in size, as against the old standard of about three-sixteenths inch only, while revolving screens, with aperatures of about four-sixteenths inch, let out the fines and return the oversize to auxiliary machinery for recrushing. The coarse stamping system has resulted in giving about 50 per cent. of the mill product from the stamps, before jigging, as against 10 per cent. extracted at the heads under the old method, thus affecting important economies in the amount of material handled in stamps and jigs, and reducing the quantity of slimes.

From the stamps the crushed rock is fed to jigs, which are in series, taking coarse and fine sands from the stamps. A portion of the coarse sands, discharged as tailings, is recrushed and rejigged. Various types of regrinding mills are in use, including Chilean mills and other forms. The cost of regrinding Calumet & Hecla conglomerate, which is extremely refractory, has ranged as high as 30 cents per ton in Chilean mills, but in Huntington mills the cost has been cut to 10 cents per ton. The fines and slimes are passed over slime-tables of various patterns, these including the old-style Evans round-table, frequently with two or three superimposed decks, to save floor space, and the Wilfley and Overstrom patent tables, which have given very satisfactory results. The waste sands are washed through launders to some distance from the mill, while the concentrated metal, with its adhering gangue-rock, known locally as mineral, is shipped to the smelters for reduction. Formerly the mill practice of the Lake Superior district called for dressing mineral to a high percentage of metallic contents, but modern practice yields mineral much lower in copper tenor, and the losses in tailings now average only about one-half as much as at the beginning of the last decade of the Nineteenth Century. The mineral produced by the Lake Superior mills varies greatly, ranging

from 50 to 80 per cent. in copper tenor. Most of the mills make several different grades of mineral, these varying in size of material, and also in richness, the coarser grades carrying the larger percentage of copper. In some of the mills the coarser mineral is hand-picked for particles of silver.

Water consumption has been reduced about one-third through coarse stamping and other economies. Owing to unlimited water supply, and the enormous capacity of their pumps, the Lake Superior mills have been very prodigal of water in their washrooms. In the last decade of the Nineteenth Century as much as 10,000 gallons of water was used for washing a ton of ore, but this consumption has been reduced to an average of about 7,000 gallons per ton, and it is evident that considerable further economies are possible.

Owing to the compounding of stamps, resulting in greatly increased crushing capacity, some of the older mills have been unduly crowded in their washrooms, with consequent losses in tailings. The newer mills provide a much larger area of washroom for each stamp, thus allowing for the greatly increased stamping capacity of each head.

The tailings of the Lake Superior mines range from 0.15 to 0.75 per cent. in copper tenor. These figures are low, but are not as low as might be wished, in view of the low average tenor of the original ore. Great improvements have been effected, however, and the losses in tailings now average no more than half those of twenty years ago. Many attempts have been made in the district, and are being continued at the Calumet & Hecla, at reworking the tailings, but so far none have proven commercially feasible. The stamp-sand from the mills is utilized locally for mortar, in building construction, and is excellently adapted to that work. The stamp-sand also is used in making sand-lime brick, and for the manufacture of paving blocks.

CHAPTER VI.

The Hydrometallurgy of Copper.

Readers desiring a detailed exposition of this subject are referred to Eissler's excellent volume entitled "Hydrometallurgy of Copper." This chapter will be found to give a fairly complete outline of the subject, but without any attempt at great detail.

The extraction of copper values from ores by simple leaching processes has been known for many centuries, and probably was discovered by some of the earliest followers of mining and metallurgy. Leaching processes vary, according to nature of the ores, and in minor details. The simplest process is that by which the water from sulphide copper mines is compelled to precipitate its copper values on scrap-iron, after reaching surface. Plants for leaching cupriferous mine waters are simple, usually, and the process is essentially the same, wherever used. At Butte the water from the mines carries .0015 to .0065 per cent. copper, and the seepage water from the tailings piles is very much richer. The oxidation of chalcopyrite in tailings is very slow, but chalcocite and oxidized ores leach much more rapidly. The tailings piles at Butte are leached by water, conveyed in ditches over the surface of the piles, and such leach-water, after leaving the tailings, goes from pond to pond, and then is pumped to precipitating tanks, in series of two or three with grades of 1 to 240 at the beginning, and 1 to 50 at the end, the copper being precipitated on scrap-iron, tin cans and other iron waste, the product being cement copper running from 30 to 90 per cent. in copper tenor. The product resulting from the precipitation of copper from cuprous sulphate solutions upon scrap iron is a very impure mixture of metallic copper with iron, antimony, arsenic, silica, etc., and is washed, sometimes repeatedly, before reduction to blister copper in blast-furnaces.

Lixiviation is especially adapted to sulphide ores of low grade, but not all low grade ores can be handled advantageously by leaching, as it is not adapted to ores containing considerable quantities of ferrous oxide, manganese or lime, while the leaner oxides, carbonates and disseminated sulphides having quartz gangues are especially suited to lixiviation. The initial outlay for a leaching plant is comparatively small, but the process is slow, and, to be even fairly complete, requires much time, for long continued leaching, in the case of average ores. Where applied on a very extensive scale, as in Spain, the principal disadvantage is the locking up of enormous quantities of ore, entailing a heavy investment, but this disadvantage, when once overcome, affords compensation by reason of the immense amount of material in process of leaching acting as a sort of balance wheel, rendering it possible to forecast production to a far greater extent than in the case of mines using ordinary concentration and smelting processes of reduction.

The mines of the Sierra Morena, in Spain and Portugal, have been worked intermittently for about three thousand years, and immense piles of low-grade sulphide ores and refuse have accumulated. As these weath-

ered, the sulphides became oxidized gradually, and natural lixiviation was brought about by the rains. The bulk of the copper so leached out was lost, but it was learned, at some remote time in the past, that the copper values could be saved by depositing scrap iron in the path of the leach-water. This process of securing copper from sulphate solutions is now in use at many old and idle copper mines as well as at active properties, in various parts of the world.

The process of natural cementation is well exemplified at the San Domingos mine, in Portugal, where the low grade sulphide ore is nobbed to three or four inch size, and piled in immense heaps, 15 to 40 feet in height, which are provided with valleys for drainage, with brick chimneys at intervals. Pipes are laid over the surface of the heap, and water is applied copiously, at intervals. The water draining from the heaps is collected in sluices, and the metal, carried in solution as copper sulphate, is precipitated on scrap-iron. Some of the heaps at the San Domingos contain as much as a million tons of partially leached low-grade ore, and require eight to ten years for the complete extraction of values to the point of impoverishment where further work, by even this phenomenally cheap plan, is unprofitable.

A modified method, which might be termed artificial cementation, was employed for a long time at the Rio Tinto mine, in Spain, but has been succeeded by a process that will be described later. By this old method broken ore was piled in roast-heaps, called teleras, in quantities of 1,000 to 1,500 tons per heap, the ore ranging from 1.5 to 2 per cent. in copper tenor. The heaps were fired, burning slowly for three to six months, after which the ore, then uniformly and thoroughly roasted, was placed in cement tanks, each about 5 feet deep, 35 feet wide and 100 feet long, provided with false bottoms of square timber. The leach-water from these tanks ran into settling tanks, where the copper was deposited on pig-iron. After five or six successive leachings the ore was removed and piled in heaps, called terreros, and weathered again for further leaching. At one time the Rio Tinto had about seven million tons of low grade ore in terreros, for further leaching.

The present leaching process in use at the Rio Tinto differs somewhat from the method previously described. The bulk of the copper values of the Rio Tinto is contained in chalcocite, distributed in pyrite, and not in chalcopyrite distributed through iron pyrite, as formerly held. The first process in the leaching of low grade ores is exposure to air and moisture, which form some ferrous sulphate, that oxidizes to ferric sulphate, which reacts, with considerable rapidity, on the iron copper sulphides, producing copper sulphate and iron sulphate. About half of the copper values contained originally are changed into the form of sulphate within six months, the final reaction producing copper sulphate and sulphuric acid. About two years are required to extract 80 per cent. of the half of the copper remaining in the leach-heaps after the first six months of leaching.

At the Rio Tinto a site is chosen for a leach-heap where the ground is concave and sloping, to permit the leach-liquor to run out from the base of the heap. The first step is the building of a network of air-flues, with an internal diameter of about one foot, connecting every 50 feet with vertical chimneys built of rough stones. The ore, crushed to not larger than 2-inch size, is spread alternately, in lumps and fines, to a height of about 30 feet.

and the surface is leveled, each completed heap containing approximately 100,000 tons of ore. The surface of each heap, after levelling, is formed into squares, by means of ridges of mineral, these serving to distribute the water locally. A system of gutters is arranged for running water over all parts of the mass, and water is run on as the heap is built up. The ore oxidizes rapidly, the temperature of the air in the chimneys rising to 170° to 180° Fahrenheit, and at the latter point the chimneys are closed, to check too rapid local oxidation, and to promote the slow and thorough oxidation of the entire heap. The pile of ore changes to a brownish color, due to the hydration of the yellowish, basic ferric salt. Great care is required to prevent firing the heap, as fire once started is very difficult to extinguish. When oxidation has proceeded as far as safe, water is supplied, at the rate of 50 cubic meters per hour, until the soluble copper is leached out, after which the heap is allowed to oxidize naturally, and the process of leaching is repeated. After about one year the squares on the surface of the heap are rearranged, and gutters are shifted. At the edges of the heap the mineral has become cemented, holding a considerable quantity of copper salts, and the edges are dug down into terraces, and the copper extracted therefrom by washing. When the copper contents have been reduced to about 0.3 per cent., the heap is considered thoroughly leached, and the residue, containing an average of 49.5 per cent. sulphur, is exported as washed sulphur ore.

The copper liquor, as it runs from the heap, has considerable ferric iron in solution, and, to remove this, the liquor is run over a smaller heap of ore, known as a filter bed, laid in a reservoir formed by a masonry dam thrown across a small ravine. The filter bed greatly reduces the quantity of ferric iron carried in solution, and the leached liquor is then run to the cementation tanks, reaching the tanks containing, per cubic meter, about 4,000 grams of copper, 1,000 grams of ferric iron, 20,000 grams of ferrous iron, 10,000 grams of free sulphuric acid and about 300 grams of arsenic, a total of about 3.5 per cent. carried in 96.5 per cent. water. The liquor is run from the reservoirs, at about 300 cubic meters per hour, through the precipitation tanks over pig iron, producing cement copper, the process of cementation being facilitated by warm weather. The precipitation tanks are arranged in series, on the slope of a hill, the leach-liquor passing forward and back, and being discharged from the lowest tank practically free from copper, but containing considerable ferrous iron and free sulphuric acid. This waste liquor coming from the cementation tanks, called salida, is pumped back and mixed with fresh water, for further use on the leach-heaps. Each series contains three parallel tanks, which are about 2¼ feet deep, 5½ feet wide and 320 feeet long, the slope at the bottom varying from one in five hundred, in the first series, to one in ninety in the last series, added velocity being provided in the final series to overcome the tendency of the free sulphuric acid to attack the pig iron more rapidly as copper is deposited from the solution. The tanks are built of lumber and the spaces between them filled in with stone and cement. No metal is used in the construction of the tanks, wooden plugs being used for joining the timbers. Cracks between the boards are filled with oakum and pitch, to render the tanks water-tight, and at each end of each tank there is a drop-door. The tanks contain about one ton of pig iron for each foot of length.

The precipitate is taken daily from the tanks, the cement copper being removed from one tank at a time. The rough precipitate is taken to the

cleaning and concentration plant, where the precipitate is cobbed from the pig-iron, which is replaced for further use. The crude precipitate so secured, containing an average of about 70 per cent. copper, is fed onto a perforated copper plate, through which it is washed by a strong jet of water from a small nozzle, into a long launder, material not passing the perforations being removed and hand-sorted. The precipitate passing into the launder is washed and concentrated, by the velocity of the water, into different grades. The first few yards of the launder produce a red precipitate, known as No. 1, that assays about 94 per cent. copper and under 0.24 per cent. arsenic. This is followed by No. 2 precipitate, assaying about 92 per cent. copper and between 0.3 and 0.75 per cent. arsenic, while No. 3 precipitate, at the far end of the launder, consisting of very fine grains, averages only about 50 per cent. copper, and up to about 5 per cent, arsenic, including also graphite from the pig-iron, and some antimony and bismuth. Nos. 1 and 2 precipitate are bagged for shipment to the refinery, and No. 3 is moistened with acid liquors, made into balls by hand, dried in the sun and then smelted and bessemerized in the ordinary manner.

A system of combined roasting and leaching, in use in the Sierra Morena district of Spain, consists of roasting copper sulphides with ferrous iron sulphate, which reduces the copper to the form of sulphate, after which it is leached. Iron sulphate is produced extensively in the ordinary cementation process.

Copper sulphides may be converted into chlorides in various ways. By one process the sulphide copper ores are treated with ferric chloride, or with ferrous chloride and hydrochloric acid, decomposition being hastened by saturating the ores under treatment with calcium chloride or sodium chloride, both cheap and common chemicals. Another process, which is quicker, and gives closer extraction, though costlier, consists of roasting the raw sulphide ores with the addition of about 1.75 per cent. salt. The ore so treated is roasted in teleras, after which the chlorurized ore is leached in vats, and the residuum placed in terreros, for further weathering and leaching. A modification of this process is in use near Pittsburg and at several other American points.

The Doetsch leaching process is not in present use, though once employed extensively at the Rio Tinto. By this process raw sulphide ores were mixed dry with about one-half per cent. of ferrous sulphate and salt, the ore being broken to half-inch size and built up into large heaps having channels and chimneys for ventilation. The weathering process required about two years, and about 80 per cent. of the copper contained was secured by leaching and cementation.

The Hunt & Douglas process is a modification of the Doetsch process, but none of the chloride processes are in very general use.

The earlier wet process of Langmade, improved by Henderson in 1860, and since modified slightly, is in quite extensive use in Great Britain. This system is designed for the extraction of small copper values from the cinders remaining from cupriferous pyrites after burning for sulphur used for the making of sulphuric acid.

Metallic copper is slightly soluble in cyanide solution, the solubility being in direct ratio to the fineness of comminution. Copper carbonates and oxides, in small quantities, have a deleterious effect on the cyanide treatment of gold ores, decomposing the solution rapidly. Copper taken into the

solution to a point where affecting its strength for gold solution can be precipitated electrolytically.

A patented hydro-electrolytic process is planned to leach copper direct from the ore and deposit pure metal electrolytically from the solution. By this process ore first must be crushed to size passing a 40 to 80-mesh screen, then calcined and leached in tanks in a solution containing 6 to 10 per cent. of sulphuric acid. It is claimed that one ampere of electrical energy will precipitate one ounce of copper in 24 hours, but this process does not seem to have passed the empirical stage.

New processes of lixiviation for copper ore are numerous, and many new systems have been patented, in different countries. Some of these new processes call for involved and intricate reactions, possible in laboratory experiments, but difficult of carrying out in the actual extraction of copper on a large scale commercially. A fault common to many new leaching processes is that materials too costly in price are required, and such processes, while technically correct, are unavailable commercially by reason of high cost. In practically all developed copper fields only the low grade ores are adapted to leaching, all ores of medium and high grades being treated by smelting, with or without preliminary concentration. Only the cheapest materials are available for leaching processes that will prove commercially successful, and the only two chemicals that seem to have met the tests as to strength and cheapness are salt and sulphuric acid, with salt losing ground in this field, in which it once disputed supremacy with the acid.

CHAPTER VII.

The Pyrometallurgy of Copper.

Smelting, or the reduction by fire, of metal from ore, has been known to mankind from prehistoric times. The reduction of copper to metallic form is effected by three methods, or combination of methods, these being hydrometallurgy, where leaching processes are employed, pyrometallurgy, where fire is the reducing agent, and electrometallurgy, with electric energy as the agent of reduction. The greater part of the world's copper production is secured with the aid of fire by smelting, but the rough copper so obtained is refined, as a rule, by electrolysis. This chapter is devoted to smelting in its various branches.

The antiquity of copper smelting is evidenced by the finding of copper and bronze in tombs and disinterred cities of very great age, and it is obvious that the copper must have been smelted, because the ancients are not known to have possessed mines of the native metal. The secret of smelting never was lost, but was handed down from generation to generation, and spread from country to country. In Europe there were copper smelters, at very early periods, in Germany, Austria and Sweden, it being obvious that the metallurgical practice of these works was derived from the Romans.

In Great Britain there are fugitive historical references to copper smelters early in Plantagenet times, and it is altogether probable that smelting was done, in a primitive manner, on tin ores, many centuries before the Christian era, and that the improved metallurgical practice introduced to the island by the Romans was never lost entirely, through the troubulous centuries preceding the welding together of numerous petty principalities into one nation, under Alfred the Great, in the year 900. In the Swansea district the earliest recorded smelter is that of the Mines Royal works, dating from A. D. 1584, though it is known that these works were preceded by still earlier smelters. The Taidach works date from 1727, and in Cornwall, copper smelters at Hayle date from early in the Eighteenth Century. The Welsh and English were the first to engage in copper smelting as an independent industry, the practice, from time immemorial, having been to smelt the ore at or near the mines, in primitive works under the same ownership. As a result of the establishment of independent works that bought ore from many mines, the Welsh smelters progressed more rapidly in metallurgical knowledge than their competitors and gained great skill in treating refractory ores. As a consequence of this progress Swansea became the seat of the greatest diversified smelting industry on the globe, the location of the city being favorable for the receipt of ore and matte from foreign countries. The smelting industry of Swansea, though still large and highly diversified, is of much less importance than formerly, the decadence of Welsh smelting having been aided, beyond doubt, by the arbitrary restrictions imposed upon the producers of the ore, for at the height of their prosperity the Swansea smelters drove very hard bargains

with the miners. For a long ton, twenty-one hundredweights of one hundred and twelve pounds each were demanded and received, in addition to which an allowance of three and one-half pounds on three hundredweights was exacted for "draftage," and allowances also were claimed for moisture. No new smelters have been built at Swansea since 1867, though perhaps nearly three-fourths of the world's copper output was smelted at that point about the middle of the Nineteenth Century.

The smelting of copper dates from time immemoral in China, Persia and India, and Japanese smelting was begun about the Seventh Century of the Christian era. In Japan the large and highly important modern copper smelting industry now in existence may be said to date from about 1890, when the first modern machinery and equipment were installed at a Japanese plant.

The change of base of the copper smelting industry of the world dates from about the middle of the Nineteenth Century, when the development of highly important copper industries in Lake Superior, Chile, Australia and South Africa led to the building of smelters near the mines. The smelting industry, so far as copper is concerned, has reverted to the ancient practice of thousands of years, interrupted for a couple of centuries by the rise of the Welsh smelting industry, and the reduction of copper ores is carried on now, as a rule, at or near the mines, though, in the case of electrolytic refining, the greater portion of the rough copper is refined at long distances from the smelters.

In Chile the first reverberatory furnaces were built in 1842, at Coquimbo, by Charles Lambert, and Lambert, who was an extensive operator of Chilean mines, opened the Port Tennant works at Swansea, in 1852, to escape the intolerable exactions of the Associated Smelters. From this declaration of independence may be said to date the decline of the Welsh smelting industry. Charles Lambert built the first Chilean blast-furnaces, at Coquimbo, in 1857, but these were not entirely successful. Chile now has a number of modern smelters, though none of the first magnitude, and a considerable amount of ore continues going to Swansea for reduction.

In Australia the first smelter was built at Port Adelaide, South Australia, in 1851, and the second was erected at Wallaroo, in the same state, in 1861. The first smelter in New South Wales was built in 1874, at Lithgow, and the first in Queensland was built, in 1888, at Aldershot, a suburb of Maryborough, while the first smelter in Western Australia was not constructed until after the opening of the Twentieth Century. In Tasmania the first copper smelting was done at a plant on the east bank of the Derwent, at Smelting Works Bay, shortly previous to 1860, but these works do not seem to have proven a success. The modern works of the Mount Lyell, which are exceeded in size by many plants, but in efficiency by none, date from 1896.

In the United States the smelting industry was slow in gaining a foothold, partially because of the policy of England in forbidding the smelting of copper ore in the colonies. There was a limited production of ore from mines in New Jersey, Vermont and elsewhere, during the Eighteenth Century and in the early decades of the Nineteenth Century, but the first American smelter of which authentic records have been found was the Revere works, at Port Shirley, Boston, Massachusetts, having cupola furnaces, which were built in 1835. The company owning the works was reorganized in 1851, and continued business as a copper smelter until 1868, and remains

in business with a copper rolling mill, though no longer a smelter. It is asserted by Nicol Brown, an eminent English authority, that a copper smelter was built by Crocker Bros. at Taineston, Maine, in 1836, but there is no town by this name in the state of Maine, and verification of the statement has not been obtained. The first thoroughly successful American smelter was built, in 1845, at Baltimore, by the Baltimore & Cuba Smelting & Refining Co., to treat Cuban ores. This plant had reverberatory furnaces, operated by Welsh smeltermen, and treated ores from Cuban mines, and later from South American mines, that previously had been shipped to Swansea for reduction. This plant, now under the ownership of the Baltimore Refining & Smelting Co., remains in existence, and has been in continuous and successful operation for upwards of sixty years.

The New Haven Copper Co. built a small smelter at New Haven, Connecticut, in 1846, and from the opening of this primitive plant dates the great copper and brass manufacturing industry of the Naugatuck Valley, now the first in this line. In New Jersey a small but good copper smelter was built in 1846, at Bergen Point, and this small beginning has resulted in the building up of the enormous copper smelting and refining industry now found on the New Jersey coast along New York Bay. The Orford works, at Constable Hook, New Jersey, were built in 1881, this being the first strictly modern plant in New Jersey.

The beginning of the Lake Superior industry may be said to date from the construction of a small smelter at Pittsburg, Pennsylvania, in 1848, by Hussey & Howe. This proved fairly successful, and the affiliated firm of Hussey & Co. built a copper smelter for Lake Superior ores at Cleveland, Ohio, in 1850. In the same year the Detroit & Lake Superior Copper Co. built a smelter at Detroit, Michigan, and shortly after the same company built the first Lake Superior smelter at Hancock, Michigan, this being located in the heart of the Lake Superior copper district.

The southern copper smelting industry dates from 1854, when two small blast furnaces were built at Ducktown, Tennessee, a reverberatory furnace being built at the same point in the following year. The copper industry of Tennessee was extinguished, temporarily, in 1863, by the American Civil War, and modern copper smelting in that state may be said to date from 1890, with the advent of the Ducktown Sulphur & Copper Co., which has been a leader in the development of successful raw sulphide ore smelting. In North Carolina a small blast-furnace was built at the Ore Knob mine in 1876.

The earliest western copper smelting was done in California, circa 1865, but the bulk of the Californian copper ore production of that day went to Swansea for smelting, and the Californian copper industry suffered almost complete extinguishment shortly previous to 1870. Modern copper smelting in California dates from 1896, when the Mountain Copper Co. erected a fine modern plant at Keswick, in Shasta county. In Arizona some crude smelting was done at an early date, but modern smelting was begun in the Clifton district of Graham county, circa 1873. Copper smelting in Utah is a comparatively recent affair, though this state now has some of the best works to be found anywhere.

In Montana the first smelter was built at Butte, in 1880, by the Boston & Colorado company, and reverberatories for matting were built in the

same year by the Parrot mine, and the Meaderville smelter of the Montana company was constructed shortly afterward.

The smelting of copper has made greater progress since the middle of the Nineteenth Century than in all the centuries intervening since the discovery by primitive man that metal could be obtained from copper ore through heat, and this progress is shown in no more striking manner than by the increase in furnace capacity. About the middle of the Nineteenth Century the capacity of an average reverberatory furnace was circa seven tons per diem, while in 1902, the capacity had reached three hundred tons. The blast-furnace had increased, by the year 1900, to a daily capacity of three hundred tons, while in 1907 the capacity of the largest blast-furnace, at the Washoe works, was two thousand seven hundred tons.

In smelting gold and silver ores it usually is necessary to provide a metallic carrier for the precious metal values, the proportion, by weight, of the gold and silver being so small that it is necessary to collect these metals in some other metal of less value, but found in the ore in larger quantities. The preference, until recently, has been for lead, as a collector, but there is a marked tendency, noted since the beginning of the present century, to substitute copper for lead.

Copper melts at about 2,000° Fahrenheit—2,043° according to Plattner—or approximately 1,100° Centigrade. When heated within 200° of the melting point the metal becomes brittle and friable. Copper, when fluid, at white heat, is of a beautiful sea-green color, and volatilizes slowly, combining with oxygen to give a green flame.

The old method of smelting called for reduction of the ore to metal by six stages. In the first stage the ore was roasted in a reverberatory furnace, with the addition of about 15 per cent. of fuel. In the second stage the roasted ore was smelted, with flux and fuel, to a matte of about 35 per cent. copper tenor. In the third stage the low-grade matte was roasted in reverberatory furnaces, with the addition of about 40 per cent. fuel. The fourth stage called for the smelting of the roasted matte, with the addition of about 50 per cent. fuel, to white metal of about 75 per cent. copper tenor. In the fifth process the white metal was resmelted, in reverberatory furnaces, with about 60 per cent. of fuel, to blister copper. The sixth and final process called for the refining of the blister copper by a sucession of partial oxidations. The process of bessemer smelting usually is applied to the conversion of high grade matte, as hereinafter explained, but consists essentially of any reduction of ores by means of an oxidizing atmosphere, and both pyritic smelting and semi-pyritic smelting may be considered forms of the bessemer method of smelting.

New smelting processes are of great variety, and are constantly cropping up in considerable number. Most of the new processes are patented, and in theory many are of a revolutionary nature. Unfortunately such processes have a bad habit of working out wrong in actual practice, though frequently successful in theory. The working out of a new theory of smelting, by laboratory experiments, is a vastly different thing from applying such new processes successfully in works handling immense quantities of material. A small mine or a new mine cannot afford to experiment with new and untried processes of reduction. That work should be left to the big smelters, which, with very few exceptions, are managed by experienced

and progressive men, who are ready, at all times, to try out new smelting processes that give promise of resulting successfully. The progress of metallurgy is accomplished, as a rule, by small and frequent advances, rather than by great leaps or by revolutionary inventions.

In treating sulphide copper ores, which predominate in most districts, it is necessary to expel the sulphur, and iron also, where that is connected with the copper, as in most cases. The iron can be slagged by the addition of appropriate fluxes, and, where the ores are deficient in iron, that element must be provided by ferruginous flux, iron being necessary in the formation of free slags in copper smelting. As most of the sulphide ores possess an excess of sulphur, it was customary, until quite recently, to drive off the excess of sulphur by roasting before smelting. This work is done still, at many smelters, while at other works roasting has given way to pyritic smelting, or semi-pyritic smelting, as hereinafter described. Excess of sulphur may be removed from ore by heap-roasting in open air, by roasting in shaft furnaces or kiln furnaces, or by calcining in reverberatory furnaces, usually of a special pattern, with rabbles.

The process of heap-roasting is inherently defective, and seems doomed to gradual extinction, semi-pyritic smelting, commonly known as raw sulphide smelting, being preferable, in most cases. While the theory of heap-roasting is the same in all cases, there are many minor modifications. At the Rio Tinto mine, where heap-roasting has been discarded, the heaps were of enormous size, and were burned with a marvelously small amount of carbonaceous fuel. Under the former practice at this mine, hand-selected rich ores, averaging 8 to 10 per cent. in copper tenor, were piled into heaps of about 400 tons each, and fired with a single cord of wood, burning six to nine months each. At the Tyee mine, in British Columbia, the process of heap-roasting has been carried pretty closely to perfection. Ores are dumped from the railroad hopper-cars into sixteen 100-ton receiving bins, with hopper-bottoms and screen-tops, latter set at angle of 40°, all fines under three-eighths inch mesh falling into separate compartments built in the center of each bin. The level of the roast-yard is about eight feet below the tram-tracks that run under the receiving bins. The yard has six permanent trestles, sixty feet apart from center to center, and at right angles to the permanent trestles are six trenches, each four feet deep and forty feet from center to center. Between the permanent trestles are movable bridges, traveling on wheels, these being trussed so as to clear the roast-heaps below. Both permanent trestles and movable bridges have tram-tracks, with turntables, over which travel side-dumping ore-cars, which thus obtain easy access to every square foot of the roast-yard. Roast-heaps are built up automatically, by dumping the tram-cars, each heap averaging twenty-four by fifty feet in size on the bottom, by seven feet in height, and containing an average of 300 tons. Each roast-heap requires an average of eight cords of wood, and burns about three weeks, reducing the sulphur contents to about 5 per cent. The system works perfectly, cintering being reduced to a minimum. When roasted, ore is shoveled into 4,500-pound ore-cars, traveling on tram-lines laid in the bottom of the trenches before mentioned, the tops of the cars being on a level with the bottoms of the roast-heaps. Roasted ore is trammed to the burnt-ore bins, 1,500 feet distant and just behind the blast-furnace build-

ing, there being eighteen fifty-ton bins, with central bottom-discharge gates, emptying into tram-cars running over scales to the charging-floor of the furnace.

In the case of ordinary heap-roasting, where it is not practicable to go to the expense of providing a system so well devised as at the Tyee, ground should be selected with sufficient slope to provide good drainage, and ditches should be dug to carry off rainwater, and also to divert the drainage of adjacent ground, as a large proportion of the metallic values contained originally may be leached out by water in a short time. Usually the ground is surfaced by broken rock or slag, and given a final top-dressing of clay, well rolled or pounded. Above this should be placed a layer of fines, three to six inches deep, to prevent baking the clay, followed by its inclusion with the roasted ore when the latter is removed. On this surface of fines the roast-heap proper is built. There is a first layer of wood, much or little according to the nature of the ores, and usually more than really is needed. The worst wood available will do very well, if care is taken to furnish a little good wood for kindling the fire. Channels are provided, so that after the wood has burned out there is draught through the heap. Chimneys of boards are built at various points, the number of channels and chimneys depending on the size of the heap. In American practice a cord of wood is used for an average of 30 to 50 tons of ore, the percentage of fuel growing less as the size of the heap is increased. The first layer of ore is in coarse lumps, two to six inches in size, or even larger, surmounted by a layer of ragging, or medium-sized lumps, and topped with a layer of fines. The greater the percentage of sulphur, the lower the height of the pile. The shape of the heap on the ground may be square or oblong, usually the latter, to facilitate upbuilding and removal. In a roast-yard it is necessary to have a considerable number of heaps, so that the process may be continuous. The heap is fired, after building, and the wood gradually ignites the sulphur in the ore, which continues to burn for many weeks. The success or failure of the process depends mainly upon careful handling, the heap requiring a small but steady supply of air, for even roasting, while too much air allowed to enter the heap will result in matting part of the ore. Heap-roasting requires much hand-labor, and has various objectional features tending to restrict its use.

Matte is sometimes heap-roasted, requiring several successive burnings, but the practice is of very doubtful utility.

The fuels used in smelting copper are of a great variety, choice depending largely upon availability and prices, as well as upon individual requirements. Bituminous coal is used extensively, and anthracite coal sparingly. Anthracite is a very good fuel, but unobtainable at reasonable prices in most copper fields, while bituminous coal is the most objectionable fuel, and, next to charcoal, the least used, though there is a great difference in the varieties of bituminous coal, some of which work well in partial or complete fuel charges, while others give most unsatisfactory results. Coke, which is the most common fuel, was utilized first at Freiberg, in 1818, and proved an immediate success. For satisfactory work, in either reverberatory or blast furnaces, coke should develop not less than 10,000 British thermal units. Wood is used extensively in Chile, and in

some other districts. Charcoal sometimes is employed in blast furnaces, but for this use should not be burned dead in the kilns or pits, as in such case combustion is too rapid in the furnace, leaving a frozen charge. Where wood or charcoal must be burned for fuel, on account of local conditions, wood-burning reverberatories are preferable, as a rule. Petroleum sprayed into the firebox has been utilized in reverberatory furnaces, and in Transcaucasia is the principal fuel, giving thoroughly satisfactory results. Apparently petroleum is not well adapted to blast-furnaces, as experiments along that line have not proven successful. Gas is used to a limited extent in reverberatory furnaces, giving satisfactory results.

The nature of the charge placed in a furnace depends, necessarily, first upon the ores available, and secondly upon the nature of the principal ore or ores to be smelted. Some ores are so constituted as to be self-fluxing, containing in themselves the necessary iron, silica and limestone. In most cases it is desirable to blend the various copper ores, where the required grades can be secured, rather than to add barren fluxes, but this process depends largely upon the availability of the ores desired. One of the principal reasons for the success of big custom smelters lies in their ability to mix varying ores, from different districts, so as to lessen or entirely obviate the use of barren limestone, silica or iron ore, for fluxing. The use of "sweeteners" is to be commended, where such ores are obtainable at reasonable prices. Ores that are excessively silicious require fluxing with ferruginous copper ores, or with iron ores that are barren of copper, and vice versa. Local conditions regulate practice, and the soundest theories must step aside, at times, in the presence of prohibitory freight rates, which, unfortunately, seem entirely too common, in many of the important copper districts of the world.

In the use of silicious fluxes it should be borne in mind that all silicates are not SiO_2, which is pure silica. Quartzite or some other form of SiO_2 is much preferable to bisilicates or trisilicates, and, of course, the best silicious flux of all is a low grade ore, with gangue composed mainly of SiO_2 carrying appreciable values in gold, silver or copper, or some combination of these three metals. Barium sulphate is difficult of reduction, and ores having a heavy barite gangue are refractory in smelting. Excellent results have been secured at the Ladysmith smelter on burnt ore averaging 38.87 per cent. barium sulphate, a general average analysis of slags from this heavy barite ore giving only 0.37 per cent. copper.

In the case of native copper from the Lake Superior mines, which reaches the smelter with only 20 to 50 per cent. gangue rock adhering, the process of reduction is simple. Oxide and carbonate ores are smelted readily, but with sulphide ores it is necessary to utilize different methods as hereinafter explained. Pyritic and semi-pyritic smelting are employed successfully in some works treating sulphide ores, but the usual process of reduction calls for preliminary roasting, in yards, or, more frequently, calcinination in reverberatory furnaces, before charging for smelting. The full treatment of sulphide ores is given later, in this chapter.

Fines, coming either as fine concentrates, slimes or flue-dust, best can be smelted in reverberatories, on account of the heavy draft of the blast-furnace blowing out large quantities of the fines as flue-dust, but fines can be smelted with fair success in blast-furnaces by briquetting before charg-

ing. The briquettes made from slimes frequently include flue-dust, and are charged while moist, or the briquettes may have lime or other material for a binder, if necessary. Fines charged directly into blast-furnaces cause the growth of crusts on the sides of the furnace, together with the formation of excessive quantities of flue-dust, thus reducing the output both through losses in fumes and reduced capacity of smelting. Cement copper is a reddish precipitate, composed of metallic copper and sundry impurities, requiring smelting and refining before use. Copper bottoms are alloys of metallic copper and metals existing in the matte as impurities, formed in matting.

Ore bedding is a system by which ores of various grades are stocked near the furnace, and used as required, for mixed charges. In using this system concrete or stone-lined pits, shallow and narrow, but long, are built beside railroad tracks, and ore is dumped into them from railroad cars coming from the mine. Different grades and varieties of ore are kept in different pits, and these, as needed, are scooped up by a steam-shovel and loaded into cars for carrying to the furnaces. The system is suitable only for large works that can afford a steam-shovel, and the value of the method is dependent largely upon the thoroughness with which the plan is carried out.

Mechanical charging is preferable to hand charging in all but small works, and is in very general use. For blast-furnaces, charging is best done by means of side-dumping cars. For reverberatory furnaces the best method of charging is through hoppers in the roof, near the firebox end, and, in the case of the larger reverberatory furnaces, the process is semi-continuous. In Lake Superior smelting with reverberatories the mineral is loaded into one or two-ton side-dumping tram-cars having V-shape bottoms. These are loaded transversely on railroad flat-cars, and are unloaded onto trestles leading into the smelters, the dump-cars being discharged either into bins, for storage, or direct into the hoppers above the reverberatories.

Furnaces for copper smelting are of two classes, the first being the blast-furnace, which has a powerfully reducing atmosphere, and the second being the reverberatory furnace, where the reflected flame gives a neutral atmosphere. The comparative availability of these two classes of furnaces depends largely upon local conditions, and in many plants both forms are found. The choice of kinds of furnace should be based upon a careful consideration of all the circumstances of each individual case. There is no large difference in cost of equipment between blast and reverberatory furnaces, though as a rule the latter are somewhat more costly. Blast-furnaces and their adjuncts occupy only about half the space required for reverberatories. Blast-furnace slags usually run a little higher in copper than reverberatory slags, under similar conditions, but there is a considerable variance according to the circumstances of each case. Reverberatories make very much less flue-dust, as they lack the blast that is such a powerful agent in carrying off fine particles of solid matter in the gases from blast-furnaces. Reverberatories require only about 50 per cent. of the power of blast furnaces, and a slightly smaller force of workmen for an equal capacity.

The blast-furnace was the earliest smelter of any sort, and its age is

greater than that of history itself. Crude forms of the blast-furnace are found in use still, in remote portions of Mexico, South America, the Philippines, China and elsewhere. In the original form the blast was supplied through hollow tubes from human lungs. In fact, iron is made, to this day, in remote oases of the Sahara desert, with the aid of human blast. The next step was the invention of a crude bellows, and to supply continuous blast, two bellowses were used, worked alternately, the blacksmith's forge of today being merely a slightly improved form of the blast-furnace of prehistoric times. In its crudest form the blast-furnace is an open pit, or shallow depression in the ground. The next step is a small oven of stone, into which ore and fuel are charged. The development of the blast-furnace, to its present size and efficiency, has been accomplished by a steady succession of little improvements, covering many centuries, rather than by single strides, yet it may be said, with safety, that blast-furnace smelting has been improved more in the three past decades than in the five preceding centuries. Increase in the number of tuyeres was begun at Freiberg in 1845. The movable forehearth, now in general use, is an American invention, of comparatively recent date. The growth of the blast-furnace in capacity has been marvelous during the past few years. In 1900, the closing year of the Nineteenth Century, the largest blast-furnace in existence had a daily capacity of about 300 tons only, yet in 1907 the largest blast-furnace in use, at the Washoe works, Montana, had a length of 86 feet and a daily capacity of 2,700 tons. This single furnace, running on 6 per cent. ore, which probably was about the average of copper ore smelted at the beginning of the Nineteenth Century, could have turned out, in less than 60 days, all of the copper produced in the world in one year, one hundred years ago. The big blast-furnace at the Washoe works, made by cutting out the end-plates and joining a number of contiguous cupolas into a single furnace, has resulted in a very considerable decrease in fuel consumption per ton of ore treated.

The date of invention of the water-jacket blast-furnace remains a subject of dispute. A ten-ton blast furnace of two feet diameter, built by Wendt, in 1876, was given a water-jacket. Two years previously, in 1874, a water-jacket was installed at the Longfellow mine, in Arizona, which was 800 miles from a railroad, at that time, with fire-brick costing one dollar each and of short life, the ore being highly basic. J. B. Cooper states that the first water-jacket blast-furnace was used at the Detroit smelting works previous to 1864. While blast-furnaces are used occasionally with fire-brick linings, water-jacketed cupolas are employed almost universally. Despite the considerable loss of heat resulting from the circulation of water between the inner and outer shells, the water-jacket has proven itself both efficient and economical. Furnaces usually are rectangular, though occasionally circular or oval, with jackets of soft steel, wrought-iron or even cast-iron, and occasionally of copper.

The smelting of copper ore in a blast-furnace is a process of reducing the metal from its ores by the use of carbonaceous fuel, usually coke, in a cupola having a blast of air, which may be drawn direct from the atmosphere, or heated before passing into the furnace through the tuyeres. Blast-furnace smelting is adapted to the reduction of almost all of the commercial ores of copper, though for certain specific uses reverberatory

furnaces are to be preferred. Fuel and flux, in the quantities demanded for reduction and slagging, are added to the ore, the flux being barren, or containing metallic values, as circumstances may dictate.

Preheated air for the blast was used first by J. B. Neilson, in 1828, at an iron furnace, and was used first on copper at Freiberg, in 1837, but did not prove fully successful there, though utilized permanently at Kongsberg, where it was installed shortly afterward. The rotary Roots blower was the first in American use, and remains the principal producer of slightly compressed air for blast-furnaces. The pressure under which blast is furnished depends mainly upon the depth of the bath, it being evident that increased pressure is required to force air through an increased depth of molten matter, the average pressure being 14 to 16 ounces per square inch. Blast is heated to greatly varying temperatures, ranging up to 800° Fahrenheit at some works, and the heating may be done in several ways, the most economical method being the heating of the blast by waste gases from the furnace itself.

The date of invention of reverberatory furnaces seems uncertain. The earliest British record of furnaces of reverberatory type is dated 1765. Furnaces of this class can be made, at a pinch, of adobes or sun-dried brick, and these, while crude, and not recommended for use where better material can be had, give fairly satisfactory results in the hands of a first-class smelterman. In the reverberatory furnace the flames from a lower grate, on which the fuel is burned, are reflected back upon the ore, lying on a bed above, thus giving a neutral atmosphere. The forehearth is brick-lined, and movable, and the air entering the furnace may be preheated, though this is not customary. In the best average practice five to seven tons of ore are smelted per ton of fuel burned, the larger furnaces giving the lower ratios of fuel consumption. In the case of sulphide ores the reverberatory furnace produces a richer matte than from the same ores reduced in a blast-furnace.

During the past thirty years the reverberatory furnace has gained tremendously in size. In 1878 the capacity of the average American reverberatory was 12 tons only, but had increased to 24 tons in 1887, and, in the case of the larger furnaces, had increased to 50 tons in 1894, 150 tons in 1899, and 300 tons in 1902. The largest reverberatory furnace in existence is at the Washoe works of the Anaconda mines, in Montana, this being 19 feet wide and 116 feet long, with a daily average capacity of about 300 tons.

In the Lake Superior district the smelting of copper mineral is done in reverberatories. The charge is first melted down, with fuel and flux, anthracite coal and coke constituting the fuel and limestone the flux. The products of the first fusion are slags rich in copper, which are resmelted, and impure copper, which is tapped to a refining furnace, where rabbled by blowing air through a gas-pipe, this process having an oxidizing effect on the charge. The copper is then poled with staddles of green wood, to bring it to the proper pitch, when it is dipped and moulded by hand, or tapped into mechanical casting machines. It is possible to perform the entire operation of fusion and refining in the refining furnace alone, but in practice it is found profitable to separate the work into the two operations previously noted. The standard Lake Superior reverberatory furnace is 13x17 feet and the largest in the district, previous to the building of the Michigan smelter,

was 17x28 feet. At the Michigan works a furnace 20x50 feet was built, but, after repeated trials, this was found too large to hold the heavy charges of mineral, and was cut down to 16x35 feet in size, and furnished with a 24-inch ventilated bottom.

The bulk of the world's copper supply comes from sulphide ores, and, while leaching processes are used to a considerable extent, the far greater part of the sulphide ores is reduced by heat alone. Unless pyritic or semi-pyritic smelting be employed it is desirable that as much as possible of the sulphur be eliminated before the ore goes to the smelter. Preliminary roasting or calcining may be done in the open air, by heap-roasting, as previously described, or by roasting in stall, shaft, or kiln furnaces. The roasting of sulphide ores may be reducing or merely oxidizing in nature. The calcination of copper ores is a simple process, in theory, but in practice requires nice discrimination and care, to secure the best results, owing to the varying proportions of copper, iron, sulphur and other elements found in the raw ores. The skill with which the calcining is done greatly affects the success and cost of the future processes of reduction. As the combinations of ore vary greatly in different districts, the practice also varies to a considerable extent, and the best practice for the calcination of a given ore is determined, first by theory, and secondly by actual work.

Calcining may be done in hand-furnaces, but automatic devices are more economical, and are in general use in all but the smallest and least modern works. Hand reverberatory furnaces,with the hearth heated by a fireplace separated from the furnace by a bridge-wall with side openings, give as good satisfaction as can be secured with hand furnaces. Muffle furnaces are used occasionally, though not extensively, giving a very equable heat, but proving expensive in operation. Hand power cylinders are used at times, but are not so economical as mechanically operated calciners. The Brückner automatic intermittent discharge cylinder, invented 1864, has a greater diameter and shorter length than other varieties of cylindrical calciners, hence it takes less floor space, and is automatic and efficient in operation, being in quite general use. The Douglas muffle cylinder calciner, with continuous discharge, has a central flue of tile, which takes combustion products direct to the chimney. This calciner, while suitable for general work, is especially adapted to the economical and cleanly saving of sulphur fumes for the making of acid.

The principal form of calciner is the automatic reverberatory, of which there are a number of varieties, mainly patented, all of more or less value. These consist essentially of stationary reverberatory furnaces, through which plows are dragged, to rabble the ore under calcination and to remove the calcined ore. One of the most efficient forms is the turret furnace in which horizontal revolving plows are actuated from a central shaft, the ore charge being fed automatically from hoppers above. The turret furnace is economical of floor space and attendance, and may be built with a number of decks. The four-hearth Welsh calciner has hearths of 16x16 feet. The O'Hara calciner, with straight hearth, was the first to use mechanical rabbling, with plows set on horizontal arms attached to an endless chain. The turret calciner of Pearce, with superimposed hearths, came out in 1892. The McDougall mechanical calciner, invented 1891, is the type found in most general use. This has numerous superimposed hearths, some furnaces having

as many as six, each rabbled by rotating arms carrying plows. The Argall furnace has a hearth with reciprocating movement, rabbles being lifted automatically when the hearth makes the return movement.

Ores are roasted also in kilns, stalls and shaft furnaces. A stall furnace is merely a perfected form of heap-roasting, wherein brick, stone or slag-block walls are built about the roast-heaps, giving perfect regulation of air currents. Where necessary a roof is built, to prevent the access of rainwater, which would leach out a considerable part of the copper values. In the most modern forms of stall furnaces, paved or grated floors are added, and stalls grade into furnaces by the addition of flues and chimneys for the carrying off of roast-gases. The Gerstenhöfer shaft furnace, utilizing the sulphurous fumes for making sulphuric acid, consists of a vertical shaft with a mechanical device for feeding the charge from above, and the fresh pulverized ore is intercepted in its downward progress by projecting ledges, permitting its partial oxidation. Kiln roasting also is employed where sulphurous fumes are saved for making acid, the kilns being of shaft-like form. The advantage of kilns and shafts is found mainly in the saving of the sulphurous fumes, but the process of desulphurization is more complete than is possible in heap-roasting or stall roasting.

Matting is the process of making a semi-metallic compound from sulphide ore, materially richer in copper than the ore treated. In the process of matting a considerable proportion of the sulphur in the ore is thrown off in fumes, and a large part of the original gangue is eliminated as slag. A definition of matte, or regulus, as it sometimes is called, is exceedingly difficult to give, for the reason that matte may contain greatly varying proportions of any of its elements, and a considerable variety of elements, of which sulphur always is necessary, copper being necessary, of course, in a copper matte, and lead in a lead matte, while iron, arsenic and a number of other impurities, some valuable and others damaging, are found in greater or less number and proportions in different mattes. Copper matte may contain as little as 15 per cent, or as much as 75 per cent. of the metal, though usually rainging from 25 or 30 per cent., in the lower grades, up to 50 or 55 per cent. in the higher grades. Copper matte is an intermediate product between raw or calcined ore, usually the latter, and the finished copper product. Matte is variously considered as an alloy, a mechanical compound or a mechanical mixture. It obviously is a semi-metallic product, possessing certain metallic characteristics, such as malleability, which is quite marked in the case of some high grade mattes. The mattes of high grade have specific names, according to their copper tenor. Blue metal is a matte containing 60 to 65 per cent. copper; white metal runs 70 to 75 per cent. copper; pimple metal carries 80 to 85 per cent. copper. Black copper is impure metallic copper carrying 1 to 5 per cent. sulphur, also sundry metals and metalloids, the name coming from the oxidation of the surface to a dull black. Blister copper is the highest grade of unrefined metal, carrying 96 to 99.5 per cent. copper, with one per cent. or less of sulphur, and small, variable quantities of other impurities. Its name comes from the blebs or vesicles, in which the bubbles of gas, from sulphur and other volatile elements, are retained as the copper hardens. Blister copper looks well, and is suitable for many uses, but, with the exception of the unusually pure metal from Lake Superior mines, blister copper is red-short, as a rule, though

not cold-short in most cases. The quality of blister copper varies greatly, the purer brands being of good commercial grade, while the baser qualities are suitable for rough copper uses only.

The tendency of present practice is away from the old plan of blowing up a matte to blister copper by easy stages, and in the most modern plants only two fusions are required between calcining and bessemerizing. The separation of matte from the slag depends mainly upon specific gravity, hence the separation is imperfect when heavy basic ferruginous slags are produced, while light silicious slags usually are quite free from matte. Copper bottoms are alloys of metallic copper and other metals existing in the matte as impurities. The formation of the bottoms purifies the matte, and such bottoms are resmelted. In matting it is found that small furnaces are exceptionally liable to freeze. The product of the first fusion in the reverberatory matting process is of low grade, ranging from 15 to 50 per cent., usually 25 to 40 per cent., in copper tenor. If the charge is blown up to more than 50 per cent. copper at the first fusion, the slags are almost certain to carry considerable copper, entailing direct losses, or necessitating resmelting.

Blast-furnace slags, as a rule, run a little higher in copper than reverberatory slags produced from the same ore. The chemical composition and physical properties of slag vary according to the nature of the ore and fluxes, but usually slags are rich in both iron and silica. In Lake Superior smelting practice the reverberatory slags run 10 to 25 per cent. in copper tenor, and are resmelted in blast-furnaces, which, in turn, give slags carrying only 0.75 to 1 per cent. copper. An average of 10 per cent. copper in reverberatory slags is considered good practice in the Lake Superior district, the nature of the material treated differing greatly from the ores of other districts. The rich slag, containing much cuprous oxide, is skimmed off at the end of poling.

The scoria, or slag from a smelter, accumulates in large quantities, and its disposal sometimes becomes a matter of difficulty. Various systems are in use for disposing of slag, the simplest being to let it run outside and care for itself, but this is possible only where there is a sharp incline and plenty of room, conditions frequently lacking about a modern smelter. Where it is impossible to permit the slag to care for itself, the cheapest method of disposal usually is by granulation, which is accomplished by running the molten slag into a trough conveying a small stream of rapidly running water. The slag granulates instantly, and is washed away by the water and deposited by gravity at any point desired, granulated slag being sluiced in water almost as easily as coarse sand. Slag may be disposed of also by removal from the furnace in slag-pots, transported by hand, horse or mechanical power, or may be run out in gutters, while liquid, though somewhat difficult of handling by this method because of its viscosity. At a number of smelters slag-bricks are made, and while these are not suitable for general building purposes, they are available, to a considerable extent, about a modern reduction plant, and make satisfactory brick for almost any rough use.

In calcining or smelting copper ores, varying proportions of the metal are volatilized and carried off with the roast-gases, while fine particles of unsmelted ore may be carried out of the smelting zone by the powerful draft of a blast-furnace. Formerly the copper blown out in fine particles, and

volatilized by intense heat, was lost, but in all modern plants the greater part of such furnace loss is regained by deposition in dust chambers. It has been found advantageous to make the dust chambers of great length, which permits the settling of the small solid particles from the fumes, and the sublimation of the volatilized copper along the course of the flue. Dust chambers are found in all modern plants, and as a rule are merely enlargements of the flue, having transverse partitions permitting the gradual settling of the dust from the furnace fumes. In the larger plants the flue-dust is removed from the dust chambers through hoppers underneath, which load into tram-cars. As flue-dust usually is high in arsenic and antimony, volatile elements that are highly deleterious to finished copper, flue-dust commonly is smelted by itself, though sometimes mixed with matte or briquetted with fines previous to resmelting.

Fumes from sulphide ores are injurious to vegetation, and lead to much litigation. There is no question that much damage is caused to agricultural interests by smelter fumes, and equally there is no question that an industry of mulcting smelters has grown up among agriculturists in various smelting districts. The courts usually hold with the farmers, and increasing trouble is caused the smelters, with prospects of still more serious trouble in the future. It has been suggested that smelter fumes be concentrated and turned into the streams, but this suggestion is not practicable, as the damage would be far greater than now caused by dissipating the fumes in the air. The sulphur fumes from roast-heaps are especially objectionable, as they lie low on the ground, doing far more damage than the fumes thrown off from high stacks. Owing to the increasing difficulties of smelters with surrounding agriculturial interests, because of noxious fumes, it is certain that the sulphur contents must be used, to an increasing extent, in the manufacture of acid.

One ton of sulphur combined with oxygen and water makes three tons of sulphuric acid, which is the basis of all other inorganic acids, and may be called the foundation of commercial chemistry, as there is scarcely a single branch of chemical manufacture that does not depend, directly or indirectly, upon sulphuric acid. Previous to 1838 the volcanos of Sicily were practically the sole producers of sulphur for the making of acid, but owing to a short-sighted attempt at unduly raising prices, the cost of sulphur was made almost prohibitive, leading to the utilization of the sulphur contained in iron pyrites, more especially the cupriferous pyrites of Cornwall, Wales, Ireland, Portugal and Spain, incidently having a strong influence in reopening the principal copper mines of the Iberian Peninsula, which are notably rich in sulphur. Sulphuric acid can be manufactured easily by passing sulphurous acid fumes, given off from sulphide ores roasted in shaft-furnaces or kiln-furnaces, through lead-lined acid chambers, where the fumes are taken into solution by water. The contact acid process, a comparatively new invention, is available for making sulphuric acid from fumes containing only a small percentage of sulphur dioxide. The United States lags behind Great Britain and Germany in this detail of the copper industry, and, as has been pointed out by Prof. Douglas, the United States, while leading the world in some branches of metallurgical practice, is by no means well to the front in the fullest possible utilization of by-products.

The process of conversion, or bessemerizing, now in very general use in

copper smelters treating sulphide ores, which reduces high grade matte to blister copper, dates, in its inception, from 1855, when the first patent for making steel from iron by his new process was taken out in England by Sir Henry Bessemer. The first attempt at utilizing the Bessemer process for the conversion of copper was made at the Bogoslovsk mine, in the Ural Mountains of Russia, by Seminikov, who did not succeed, however, in producing metallic copper. In 1880 Pierre Manhes begun experiments at Verdennes, near Avignon, France, and the process of bessemerizing, as applied to copper, was brought to a commercial basis by Manhes, though somewhat improved by Paul David in 1881. The first successful converters made by Manhes, at Lyons, France, took 3-ton charges. The process was brought into the United States in 1883, by Franklin Farrell, who installed a Manhes plant for conversion at the Parrot mine, in Butte, Montana, considerable improvements in the practice being made at the Parrot plant. Since then the process has enjoyed great growth, having come into practically universal use for the final smelting of sulphide ores.

The first converters utilizing the Bessemer process were very small in size, treating only 2,000 to 3,500 pounds of matte at a charge, and were rotated by hand, the operation requiring two stages. Converters now in use run 12 to 15 tons in size, as a rule, though the Washoe plant of the Anaconda has trough converters 96 x 150 inches in size, and the largest converter ever built is at Butte, Montana, being of the tremendous and somewhat unwieldy size of 8x20 feet. The weight of charge in a converter varies greatly, the first charge in a newly lined shell being much smaller than the last, owing to gradual destruction of the lining.

Bessemer converter plants vary greatly in size, at different works, but the essential plan is the same in all cases. A single unit consists of a stand, one or more movable shells, and an air-compressor to furnish blast. As a rule there are about two shells for each stand, as shells must be newly lined from time to time. The stands, built of steel, hold the shells containing the charge, which are mounted on trunnions, and the stand is provided with devices for tilting the shell. Hand power for tilting is used at some of the smaller installations, but in all larger plants mechanical power is employed, rotation usually being accomplished by electric or hydraulic power. A blast of varying strength, averaging about 15 pounds per square inch, is furnished by an air-compressor connecting with the shells through ball valves, which have replaced the old style plugs. The number and size of the tuyeres through which the blast enters the retort vary according to the style and size of the converter.

The retorts, or shells, are made of boiler-plate steel, in three parts, with flanges which are strongly bolted together. Shells are of widely varying sizes and types, the principal styles being the barrel type and the upright round type. The barrel type being easier to handle, both on and off the stands, is in most general use. The shells are lined, sometimes with firebrick, though this is going out of style, the usual lining being silicious material thoroughly tamped in and dried. The most common converter lining is made of quartz and clay, the latter serving merely as a binder. In some cases it is advisable to use silicious low grade ores for linings, to save the mineral values, but such linings rarely give us good results as those made of pure silica. Magnesite linings have been used with success, at Butte, and are said to have given unusually long service. The lining of longest aver-

age life seems to be that made from quartzite containing about 85 per cent. silica and 10 to 12 per cent. alumina, bonded with clay. The life of linings varies greatly according to different factors, high grade matte containing little iron being least destructible to linings. The usual lining consist of practically pure quartz, or gannister, containing 98 to 99 per cent. silica, bonded with a little clay. The quartz or other silicious material usually is crushed in rolls to pass a ⅝-inch trommel, or may be crushed in a Chilean mill or grinding pan. Quartz and clay are dumped into large bins, in the lining department of a smelter, and are withdrawn and mixed as necessary in a mixing pan, or trough. The lining is done in sections, the lower section being tamped with a mixture of about one part clay to five or six parts of quartz, mixed rather dry, while the upper portion is lined with a softer mixture. The lining is tamped in, sometimes by hand, but mainly mechanically, with heated bars, and the linings, when completed, vary in thickness from about 30 inches, at the tuyeres, to extinction at the mouth of the shell.

In the actual process of conversion at the best arranged plants the high grade matte is run direct from the cupola well of the furnace into the converter shells. Blast is turned on automatically, by rotating the filled shell to its normal upright position, and the powerful blast, working its way upwards through the molten matte, causes the sulphur to unite with the oxygen in the air and pass off as sulphur dioxide. The converter blows off, with a tremendous roar, into a hood that connects with a flue running to the dust chamber. More or less copper is volatilized by the powerful blast, but nearly all of the metal so driven off is saved in the dust chambers, and resmelted at flue-dust. The blowing of a converter charge is a delicate process, and considerable experience and care are required to secure the best results. If the charge is overblown the slag becomes high in copper oxide, while if underblown the process of conversion is not carried out fully, and the resulting blister copper will contain an undue percentage of impurities. Owing to the greater specific gravity of gold and silver, the precious metals tend toward the bottom of the converter, and can be saved therefrom to a considerable extent, if desired, but as practically all bessemerized copper now is refined electrolytically, and gold and silver values are recovered much more perfectly by electrolysis than by any possible method of metallic segregation, the separation of gold and silver in the process of conversion is now attempted at but few smelters.

The ferric oxide formed during the combustion of the matte robs the converter linings of silica to form slag, and the life of the lining is long or short in proportion to the slow or rapid destruction of its silicious material through uniting with little or much iron in the matte to form slag. In average practice linings last for six to eight blows, though in some instances the life is much longer, and occasionally considerably shorter. The iron in the matte is eliminated before the sulphur, the oxidation of the sulphur contained in the charge being the final process. Zinc is oxidized from the matte to a considerable extent, while arsenic is eliminated but slowly in the earlier stages, and antimony remains practically intact in the matte until the final process, when it is largely eliminated in the last few minutes of blowing. The copper oxide in the matte is reduced by the copper sulphide, the sulphur becoming oxidized and passing off in fumes, while the metallic copper, as formed, sinks to the bottom of the shell. The flames

from the mouth of the shell change in color, at different stages, and are watched closely by an experienced man in charge of the process. At the start lambent greenish flames, mingled with yellow, are noted playing over the surface of the charge. At the period of skimming the slag, which is when the matte has reached the white metal stage, with a tenor of about 75 per cent. copper, blue flames are noted. When blue flames become prominent the blast must be shut off, or foaming and explosion are almost certain to be caused by violent chemical reactions that produce large volumes of sulphurous anhydride. In the best practice ten to fifteen ton converters handle full average charges, and turn out finished blister copper of better than 99 per cent. tenor, in 45 to 75 minutes. The blister copper produced must be refined electrolytically, in nearly all cases, to eliminate a considerable variety of impurities, present in the metal to only a limited extent, but highly deleterious to finished copper.

In order to prolong the life of the linings, pulverized silicious material sometimes is blown into the charge through the mouth, or placed in the bottom of the shell before charging with matte, such material furnishing a portion of the silica required for slagging the iron, and thus prolonging the life of the lining. Such pulverized material should be thoroughly dried before charging, as it may cause serious explosions if even slightly wet, when coming into contact with the molten matte.

At the British Columbia smelter, in 1906, it became necessary, while rebuilding the plant, to convert cold matte in the shells. This was accomplished by lighting a wood fire, which, when thoroughly ablaze, was covered by a charge of 1,500 pounds of coke, and a light blast turned on. When the coke reached red heat, three tons of cold broken matte were added, and full air pressure turned on. The matte melted quickly, and further broken matte was added. The slag was partially skimmed, and further matte added from time to time, until the shell was fully charged. The entire process required 3½ hours only, and 15 tons of 40 to 50 per cent. matte were converted, in one stand, in a single shift. Matte up to 55 per cent. in copper tenor was converted, but was found more liable to freezing than matte of lower tenor. The process was not economical, though necessary under peculiar circumstances, but demonstrated latent possibilities.

The casting of copper, after the final process of smelting or conversion, may be done by hand or machine. In hand work the copper must be dipped in ladles and cast into moulds by hand labor. The machines are mainly of two types, one having an endless chain, with automatic tripping of ingots into water for cooling, the second type being the Walker casting machine, in which moulds are carried on a circular platform, copper being cast through a tapping-ladle direct into moulds. Some cuprous oxide is sure to be formed in casting. Copper shrinks in casting 0.1875 inch per foot, or 1.56 per cent, as compared with 1.32 per cent. for brass, 2.6 per cent. for zinc and lead, 1.69 per cent. for aluminum and 1.04 per cent. for iron. Eutectic copper is a mutual mixture which freezes out last in casting, after ingredients in excess have been removed by gradual cooling. Eutectic copper is a mixture of metal with about 3.4 per cent. of cuprous oxide, containing about 0.38 per cent. oxygen. Under the microscope eutectic copper can be seen as a thin groundmass surrounding grains of pure copper. Eutectic copper is transparent, with blue color by reflected light and is red in transmitted light. Eutectic copper may be a

source of weakness in castings requiring tensile strength, especially in copper tubes that carry hot and reducing gases, which may react on the eutectic copper in the tubes, with the result of forming fine cracks.

The principal features of general copper refining, including impurities, are treated in the following chapter on the electrometallurgy of copper, as it seems desirable to cover the subject in one chapter, rather than in two, and the bulk of the world's copper production now is refined electrolytically.

In the middle of the Nineteenth Century refining furnaces for the refining and casting of blister copper were about 5x10 feet in size, taking average charges of seven to ten tons. The average size now is about 18x30 feet, with average charges of seventy-five tons. The oxidation of impurities contained in the copper can be accelarated by means of an air blast playing upon the surface of the molten metal. The "direct method" of copper refining consists essentially of the fusion of a mixture of raw and calcined matte, of about white metal grade, the resultant product being blister copper.

Pyritic smelting practically was invented by John Hollway, in 1878, though he did not succeed in bringing the process to do satisfactory work. The experiments of Hollway were made in an endeavor to smelt Rio Tinto copper sulphides by heat generated through the oxidation of their sulphur. The first attempts along this line in the United States were made, circa 1887, at Toston, Montana, where a partial success was scored. The first absolutely successful pyritic smelting was done by Robert Sticht, at Mount Lyell, Tasmania, in the early years of the present century.

While pyritic smelting is rather closely allied to raw sulphide, or semi-pyritic, smelting, it differs considerably in theory from that process. Full pyritic smelting practically is a bessemerizing process from the start, carried out in blast furnaces, rather than in converters, in its earlier stages. The process consists of the reduction of sulphide ores without the use of other fuel than the sulphur contained in the ore itself, whereas semi-pyritic smelting is the reduction of sulphide ores to matte with extensive use of the fuel values of sulphur contained in the ore, and with a minimum charge of carbonaceous fuel. In theory pyritic smelting is applicable to any raw sulphide ore not carrying lead. The roasting or calcining of sulphide ores drives off, by oxidation, large quantities of sulphur, which undoubtedly is a valuable fuel, providing it can be so burned as to give an oxidizing or reducing atmosphere in a furnace. Sulphide ores occasionally require a small addition of oxidized ores to serve as fluxes.

In theory one pound of pyrite, burned in a furnace, is equal to 2,026 British thermal units, this being about 35 per cent. of the calorific value of a pound of average carbonaceous fuel, but in practice the percentage of value in pyrite probably is considerably smaller. Making all reasonable deductions, one pound of pyrite probably carries fuel values equivalent to 15 to 20 per cent. of the fuel values contained in a pound of coke. The fuel value of a unit of pyrite burned to FeO and $2SO_2$ is calculated by Lewis T. Wright as 1.926, while given by other authorities as only 1.29, this comparing with 8.08 calories secured from the combustion of one unit weight of carbon burning to CO_2. It is probable that Mr. Wright's figures are a very close approximation to the actual calorific value of pyrite.

One of the principal disadvantages, and probably the greatest disadvantage, encountered in full pyritic smelting, is that sulphur will burn only in the presence of an excess of free oxygen, which greatly lowers the temperature of the smelting zone. Sulphur, when pyrite is the fuel, burns in three stages. In the first stage of combustion, pyrite, which consists of one atom of iron and two of sulphur, chemically united, loses one-third of its sulphur and forms Fe_2S_4. In the second stage there is a loss of one-sixth of the original sulphur contents, leaving a residue of FeS. In the third and final stage of combustion the single atom of sulphur is dissociated from the single atom of iron in the FeS, completing the work of reduction. This process of three stage combustion is long drawn out, lowering the temperature of the smelting zone, and causing scaffolding, and the building up of concretions of semi-fused charges on the sides, through which the blast cannot penetrate. In theory the ore should furnish its own fuel in the sulphur contained, but in actual practice it is, of course, necessary to use a little coke, to start the process of combustion, just as it is necessary to use kindling to start a fire of anthracite coal, but in full pyritic smelting no carbonaceous fuel is required, after the initial warming up of the furnace and charge.

The most successful application of the theory of pyritic smelting has been made at the Mount Lyell mine, Tasmania, by Robert Sticht. The Mount Lyell pyrite averages about 46 per cent. sulphur, 40 per cent. iron, 4.5 per cent. silica, 1.5 per cent. barium sulphate, 2 per cent. aluminum sesquioxide and 2.35 per cent. copper. To this ore is added silicious bornite, purchased from other mines, with quartz for flux. The ore is smelted without previous roasting, and without carbonaceous fuel, other than is required for preliminary warming of the furnace and charge, to a matte of 15 per cent. copper tenor. Formerly 3 per cent. of coke was used, and a hot blast of about 525° Fahrenheit was employed, but the use of coke has been abandoned and the blast is only warmed. The first fusion product, 15 per cent. matte, represents the putting of 7 tons of raw ore into one ton of low grade matte, and the process, in addition to affording a remarkable technical success, is highly successful from a commercial point of view, by reason of its cheapness. The 15 per cent. matte is recharged and brought, in the second fusion, to a copper tenor of 45 to 50 per cent., a small percentage of limestone and coke being used for the second fusion, with a cold blast. In both fusions the charge is subjected constantly to an oxidizing rather than to a reducing process. The total consumption of carbonaceous fuel averages 3.25 per cent. only, for the double smelting, all of the coke, except the preliminary warming charge, being used in the second process.

Much valuable work in pyritic smelting has been done by Lewis T. Wright, at the Iron Mountain mine, California. He found that with a cold blast the sulphur gave rather less than one-third of the total calorific power of the sulphur volatilized, while the warm blast diminished the percentage of coke in accordance with the heat generated by the increasing quantity of sulphur burned. Mr. Wright's experiments showed 39 per cent. of the total heat generated to be carried off by gases, 25 per cent. to go in slags, and the balance of 36 per cent. to pass off in radiation from the furnace and in the molten matte produced. Air to the extent of about 350 cubic feet was required for each pound of charge. The difficulties in the way of

pyritic smelting apparently are few and simple, in theory, but in actual practice results have been distinctly disappointing in the great majority of cases, hence the great measure of success scored by Mr. Wright and the complete success scored by Mr. Sticht are most notable, as well as most encouraging. That there are serious practical difficulties in the way of successful pyritic smelting cannot be gainsaid, but as these have been overcome fully in one plant, and very largely in another, while marked progress has been made elsewhere, it would seem that the process, which offers benefits that are readily apparent, should come, eventually, into quite general use, though it is improbable that it will be found suited to all sulphide ores.

Semi-pyritic smelting, or raw suphide smelting, is a system by which partial advantage is taken of the sulphur contents of the ore for fuel purposes, but differs from full pyritic smelting in that carbonaceous fuel to a varying extent, is necessary under all circumstances. This process is in quite general and growing use, and has given highly pleasing results where carried out intelligently, but experience and ability are required to secure fully satisfactory practice. The process of semi-pyritic smelting may be said to date from A. D. 1555, when the essential theory was evolved by Barthold Hohler, who first utilized iron pyrites as a carrier for the precious metals. The Kongsberg process of semi-pyritic smelting adds raw pyritic ores to the charge, simply to produce a carrier or matte for the precious metals, and differs widely in theory from the principle of pyritic smelting.

Raw sulphide smelting is done in a blast-furnace, ore being put into the furnace by layer charging or by column charging. In layer charging the raw crushed ore is blended intimately with a small proportion of coke, and the mixture is fed into the top of the furnace, there being gradual heating, followed by the ignition of the entire mass. In column charging the raw crushed ore is fed into the smelting zone of the furnace, and a strong hot-blast aids in the process of reduction, exercising a bessemerizing effect. When carefully handled, a furnace fed by column charging gives matte of good grade, with exceptionally clean slags, and turns out a large tonnage of matte with minimum coke consumption. It has been found that in raw sulphide smelting furnaces of more than four feet in width are apt to run cold, and form crusts. Considerable trouble was experienced at first through the formation of crusts on the sides and corners, necessitating frequent barring, but this trouble can be overcome almost entirely by careful charging.

The proportion of sulphur varies greatly in ores smelted by the semi-pyritic process, ranging from nearly 50 per cent., as in the case of low grade cupriferous pyrites, containing chalcocite or chalcopyrite disseminated in pyrite, to as low as 5 per cent. sulphur in the total charge, in the case of some other sulphide copper ores. Zinc up to about 5 per cent. of the charge is mainly volatilized. Alumina proves injurious, tending to form infusible silicious compounds that bring about the formation of crusts in the furnace, and also gives great trouble in the settlers.

Raw sulphide smelting has been brought to a high degree of success by the Ducktown and Tennessee companies, close neighbors in the southeastern corner of the state of Tennesse. At the Tennessee smelter the first fusion gives a low grade matte of 10 to 15 per cent. copper. This matte is charged,

broken, with silicious flux, the use of limestone having been abandoned, into a second furnace, the product of the second fusion being a matte of 45 to 50 per cent. copper tenor, though, if necessary, a matte carrying up to 60 per cent. copper can be turned out. The second fusion gives an iron slag running up to about one per cent. copper, which requires resmelting. Pyrometric tests, at the works of the Tennessee Copper Co., show that a furnace run on green ore, with a charge of only 2.5 per cent. coke, is hotter in the smelting zone than similar furnaces charged with roasted ore and 12 per cent. of coke, the excess heat produced by raw sulphide smelting ranging up to 100° Centigrade.

The Tennessee company, by changing to raw sulphide smelting, cut fuel charges of coke from 12 per cent. on roasted ore to an average of 3.5 per cent. on raw ore. The Ducktown smelter uses 4.4 per cent. coke charges only, to produce a 50 per cent. matte. This plant was the pioneer in raw sulphide smelting, and the work done there is entitled to great credit. Raw sulphide smelting reduces the output of a furnace by 20 to 30 per cent., but this reduction in output is more than counterbalanced by the elimination of the preliminary roasting processes. Raw sulphide smelting also does away with the extremely noxious sulphur fumes arising from heap-roasting. The fumes and gases from a smelter can be discharged from a high stack, causing minimum damage, while fumes from roast-heaps lie lower on the ground, and cause great injury to all surrounding vegetation. It also is possible to utilize the sulphur dioxide produced in raw sulphide smelting for the manufacture of sulphuric acid by the contact process, and this plan is to be used at the Tennessee smelter.

The raw sulphide smelting process requires 40 to 50 per cent. larger furnace capacity than the old system providing preliminary roasting or calcining, but effects enormous savings in other directions. Raw sulphide smelting requires extra labor, by reason of the double handling of matte, but this is more than balanced by the saving of one extra handling of the ore required by the old process. At the Tennessee works the saving in labor is estimated at 40 cents per ton of ore, or more than one cent per pound on finished copper, and there is an immense saving in fuel, estimated at nearly two cents per pound on finished copper.

Apparently the very considerable utilization of the sulphur contents for fuel use renders the hot-blast unnecessary in reducing strongly pyritic ores. The hot-blast has been dropped at the Mount Lyell, Ducktown and Copper Queen smelters, and never was installed at the Tennessee works, these being four of the most progressive smelting plants in existence.

The reactor process, invented circa 1901, does not seem to have proven the success that was anticipated, and is not found in general use.

Nickel-copper ores are matted quite readily, but the product is difficult of reduction, and requires special processes. The Orford works, which treat a large proportion of the entire output of nickel copper matte, utilize sodium sulphate, which dissolves copper and iron sulphides freely, forming a solution of lower specific gravity than that of the nickel sulphide. The nickel-copper matte is charged with coke and sodium sulphate into a cupola furnace. When fused the sodium sulphate is reduced by the coke to sodium sulphide, and forming a solution with part of the copper and iron sulphides, flows with the undissolved nickel sulphide through the tap-hole into moulds,

where the constituents separate according to their specific gravities, the dissolved copper and iron sulphides floating to the surface. When the mould has solidified the parts are separated by fracture, and the tops, containing copper and iron sulphides, are recharged into a smelting furnace, where the sodium sulphide is fluxed for an iron slag. The bottoms of the moulds, containing nickel sulphide, but with more or less copper and iron sulphides admixed, are resmelted by the same process as before. Formerly four or five successive smeltings were necessary to bring the nickel sulphide to sufficient purity for the refining process, but by a recent improvement a longer smelting period is given, causing more complete dissolution of the copper and iron sulphides, and two treatments are sufficient, in an open-hearth reverberatory furnace, to effect fairly complete separation of the nickel and copper, 50-ton charges requiring four to five hours heating, after complete fusion.

The Mond process of reducing nickel-copper matte takes a bessemerized matte that is dead-roasted, which is treated with a little sulphuric acid, permitting the extraction of about two-thirds of the copper contents. The full process of securing the nickel is described in the article on the Mond Nickel Co., Ltd.

CHAPTER VIII.

The Electrometallurgy of Copper.

For many years the possibility of electric smelting has excited the interest and efforts of scientists and practical metallurgists. Much experimental work has been done, and substantial progress has been gained, though no process of electrical smelting has been demonstrated fully successful. The first serious work in this line was done by Héroult, whose initial experiments on 7% sulphide ores gave mattes up to 45 per cent. in copper tenor, with slags carrying only 0.1 to 0.2 per cent. copper. Electrodes of carbon are used in smelting, and one of the principal difficulties encountered in actual work results from arcing, troubles from short-circuiting having given the most serious difficulties encountered in efforts at electrical smelting. Basing the figures upon the experiments of Héroult, about 3,000 horsepower are required for the operation of a hundred-ton furnace, and the consumption of carbon electrodes is 6 to 7 kilograms per ton of ore treated. Many electrical furnaces have been patented, but none are in commercial use as yet, on copper ores, though substantial progress has been made in the electrical reduction of iron ore. As yet there remain serious practical difficulties in the way of successful copper smelting by electrical energy, though these are being overcome, gradually, but the process, even if perfected, remains too costly for general use. It seems probable, however, that some form of electric smelting will become sufficiently perfected, within a comparatively short time, to permit its use in districts where large water powers can be harnessed at cheap cost, and where carbonaceous fuel is unusually costly.

There have been numerous attempts at the direct reduction of copper ores by electrolysis, and some of the experiments have given encouraging results. The Borchers process provides for the direct electrolytic reduction of 80 per cent. copper matte, but it does not seem that matte would furnish very satisfactory anodes. The most promising of the electrolytic direct reduction processes is that of Dr. Laszczynski, which was being utilized, in 1907, in Poland and near Semipalatinsk, Siberia. By this process ores are first crushed, then, if sulphides, are briquetted and roasted, to produce a mixture of copper oxide and sulphide. The roasted ore is then leached with dilute sulphuric acid, the product being a solution of copper sulphate, which is subjected to electrolysis, with the use of insoluble anodes. By means of an electric current the copper sulphate is separated into copper and SO_4, one atom of oxygen from the SO_4 escaping, leaving sulphur trioxide, which combines with water to form sulphuric acid. The ferrous sulphate in the anode, or rather in the electrolyte, is converted into ferric sulphate, which exercises upon the cathode a dissolving force equal to that of dilute nitric acid, reducing precipitation by fully one-half and giving a low grade and brittle metal in the cathode. The iron salts exist, necessarily, in the bluestone in large quantities, and are decidedly pernicious, but the process provides for the continuous making of sulphuric acid in the electrolyte. The anodes are of sheet lead, covered with thick cotton cloth.

Previous to a description of the actual process of electrolysis, it seems desirable to give consideration to the impurities existing to greater or less extent in all unrefined copper. The two most desirable features of copper are tensile strength and electrical conductivity, even the brass founders depending largely upon the conductivity test in purchasing copper. Tests for conductivity must be made with great care, as a variation of 1° Fahrenheit from the standard causes a variation of 0.2 per cent. in conductivity. Annealed wire gives the highest percentage of conductivity, hard drawn wire of the same metal testing 2.5 to 3 per cent. lower.

No absolutely pure copper is supplied commercially, but the best electrolytic brands are of unusual purity, some ranging above 99.95 per cent. copper, but containing gold, silver, iron, bismuth and arsenic in very minute quantities. The best grades of Lake Superior copper also are very pure, but contain small quantities of silver, iron and arsenic. Occasionally aluminum, silicon and phosphorus are added in small quantities, on account of their ability to deoxidize copper injured in heating. Molten copper has the property of absorbing such gases as hydrogen, carbon monoxide, carbon dioxide and sulphurous anhydride, which are set free on solidifying, causing difficulty in making solid castings and necessitating great care to prevent porosity. There are many mixtures of copper with zinc, tin, aluminum and other elements, forming useful alloys, which are treated elsewhere in the chapter devoted to alloys of copper.

The impurities found to greater or less extent in manufactured copper are upwards of twenty in number, including aluminum, antimony, arsenic, bismuth, cadmium, carbon, cobalt, gold, hydrogen, iron, lead, manganese, nickel, oxygen, phosphorus, selenium, silicon, sulphur, silver, tellurium, tin and zinc.

Aluminum, as shown by the experiments of Addicks, when added to copper to the extent of only 0.006 per cent., brought the conductivity of the copper down to 98.6 per cent., and the addition of 0.739 per cent. aluminum reduced the conductivity of the copper so alloyed to 43.5 per cent. The factor of ratio of aluminum in reducing the electrical conductivity of copper is 500, aluminum ranking between antimony and arsenic as a deleterious element in reducing electrical conductivity.

Antimony, like iron and arsenic, exists in most commercial copper, though usually found in small quantities. In small quantities, antimony renders copper both red-short and cold-short, but under 0.5 per cent. does not seem to greatly affect the ductility of copper, though 0.2 per cent. causes copper sheets to crack at the edges when rolled. The bad effects of antimony are partially neutralized by arsenic, but are intensified by tin, aluminum or manganese, when found in copper. Antimony to the extent of 0.0071 per cent. lowers the conductivity of copper by 1 per cent., the factor of ratio in reducing electrical conductivity being 190.

Arsenic, found in small quantities in all commercial copper, does not seem to affect the ductility of copper when existing in quantities of less than 0.1 per cent., and copper containing 0.2 per cent. arsenic can be rolled hot and is highly malleable. Arsenic in small quantities renders copper both red-short and cold-short. Arsenic is extremely bad for wire-bars, reducing ductility and conductivity, but for many uses is advantageous because giving a harder copper than the pure article. Arsenic gives no particular

trouble in smelting, but when found in copper in any considerable quantity requires elimination by electrolysis, unless arsenical copper is required for special use. Arsenical copper should contain at least three times as much arsenic as lead and bismuth combined, but should not exceed 0.6 per cent. arsenic. Arsenical copper is harder and tougher than ordinary refined copper, and has greater tensile strength. Arsenic to the extent of 0.0013 per cent. lowers the conductivity of copper by 1 per cent., the factor of ratio for lessening the conductivity of copper being 720, arsenic ranking second only to phosphorus in this respect.

Bismuth, all things considered, is the worst enemy of copper, and highly bismuthiferous ores of copper are smelted rarely, except when carrying large quantities of silver, but bismuth in small quantities is found in most sulphide ores. Bismuth is not so objectionable in smelting as in the finished metal, but can be eliminated easily, to all but a trifling extent, by electrolytic refining. In small quantities bismuth renders copper both red-short and cold-short, and the addition of only 0.002 per cent. bismuth renders copper so brittle that it cannot be rolled. The bad effects of bismuth are partially neutralized by arsenic, but are intensified by tin, alumium and manganese, when found in copper. The factor of ratio of bismuth for reducing the electrical conductivity of copper is only 4, the effect of bismuth on conductivity being so slight as to be negligible.

Cadmium, sometimes found in very small quantities in finished copper, has a factor of ratio of 9 in reducing electrical conductivity.

Carbon, in the form of carbon monoxide or carbon dioxide, may be absorbed by copper at a critical pitch of the metal, producing porosity in castings, though apparently having no other effect.

Cobalt, sometimes found in refined copper to a small extent, has about the same effects as iron or nickel, and usually is found associated with nickel, when occurring as an impurity in copper.

Gold exists only as a mere trace in electrolytic copper. The factor of ratio in reducing electrical conductivity of copper is 10.

Iron is found in practically all commercial copper, in quantities ranging from a mere trace up to appreciable percentages. In large quantities, iron is a deleterious impurity, but in small quantities seems to form an alloy with the copper, and does no appreciable damage, other than to slightly reduce electrical conductivity.

Lead, next to bismuth and arsenic, is the most damaging impurity found in ordinary commercial copper. Lead to the extent of 0.02 per cent. renders copper so brittle that it cannot be rolled, and 0.5 per cent. renders copper cold-short, while lead in copper to the extent of 1 per cent. ruins the copper for all purposes except casting, for which use the lead is a positive advantage, as it largely prevents the porosity so frequently found in cast copper. The bad effects of lead are partially neutralized by arsenic, but are intensified by tin, aluminum or manganese, when occurring as an impurity in copper. The factor of ratio of lead for reducing the conductivity of copper is only 3, this being the least harmful to conductivity of any element, and being only one-half as harmful as silver, as regards electrical conductivity, notwithstanding that silver is the most perfect conductor of electricity that is known.

Manganese sometimes occurs as an impurity in copper, to a small extent. Manganiferous copper containing 2 to 3 per cent. manganese is harder

and has greater tensile strength than pure copper, but should not contain more than traces of lead or antimony.

Nickel, in very small quantities, is a common impurity of copper, and has about the same effect as iron, reducing electrical conductivity slightly, but having no other apparent bad effect. Copper containing 2 to 3 per cent. nickel is harder and of higher tensile strength than pure copper, but should not contain more than traces of lead or antimony.

Oxygen unites with copper readily, in the form of cuprous oxide, and practically all refined copper contains a small fraction of one per cent. cuprous oxide. Up to one per cent. cuprous oxide does not affect malleability, if no other impurity is present in considerable quantities. Cuprous oxide will melt at red heat, without decomposition, and frequently becomes a component part of the refined copper. Cupric oxide in small quantities has no apparent effect on the metal, but in quantities of one-half per cent. or more lowers ductility, though not injuring the metal in other respects, even in quantities up to 10 per cent. The factor of ratio in reducing the conductivity of copper is 25, oxygen usually being found in the metal in the form of cuprous oxide.

Phosphorus, to the extent of 0.2 per cent., gives copper that can be rolled hot, and is highly malleable, but in small quantities renders copper cold-short, and, if present to the extent of 0.5 per cent., causes red-shortness. Phosphorus copper, which is harder than pure metal, should contain 99.7 per cent. to 99.8 per cent. copper, 0.05 to 0.1 per cent. phosphorus and not more than 0.04 per cent. oxygen. Phosphorus is the most deleterious element known, so far as affecting the electrical conductivity of copper, and if present in copper to the extent of 0.08 per cent. lowers conductivity to 52.3 per cent., the factor of ratio for reduction of electrical conductivity of copper being 3,000, the highest known.

Selenium occurs occasionally in crude copper, but can be eliminated quite thoroughly by electrolysis. It would seem that the peculiar physical properties of selenium should give it a greatly increased market, and in such case the metal can be secured in considerable quantities, as a by-product from electrolytic refineries.

Silicon, in even small quantities, renders copper red-short, but up to 2 per cent. does not affect ductility. Three per cent. causes brittleness, and copper containing above 5 per cent. silicon is too brittle for any ordinary use. Silicon to the extent of 0.007 to 0.042 per cent. reduces the electrical conductivity of copper less than 1 per cent., the factor of ratio for lessening the electrical conductivity of copper being 70.

Silver, which is quite thoroughly eliminated by the electrolytic process, sometimes is found in electrolytic copper to the extent of an ounce or so per short ton, and in commercial blister copper frequently is present to a much greater extent, especially in Lake copper. Silver in small quantities has no appreciable bad effect on finished copper, except for a very slight reduction of electrical conductivity, the factor of ratio for lessening the electrical conductivity of copper being only 6.

Sulphur usually is found in blister copper in the form of barium sulphate. When present to the extent of 0.25 to 0.5 per cent. sulphur causes cold-shortness, but the injurious effect may be offset by the addition of manganese or aluminum. The factor of ratio of sulphur for reducing the electrical conductivity of copper is only 8.

Tellurium, to the extent of even 0.001 per cent., renders copper appreciably red-short, and slightly larger quantities render the copper both red-short and cold-short. Tellurium has much the same effect as arsenic on copper, but to an intensified degree, and when present to a very small extent renders copper of wonderful hardness. Its use is recommended to those who are endeavoring to temper copper. Tellurium does not greatly affect the ductility of copper, and Sperry states that tellurium in high brass does not affect rolling, unless present in quantities of more than 0.1 per cent., when the brass cracks in rolling. The factor of ratio for lessening the electrical conductivity of copper is only 4.

Tin, in small quantities, renders copper red-short and brittle, but ductility can be restored, at least partially, by heating to cherry red and cooling suddenly. Copper containing 0.2 per cent. tin can be rolled hot, and is highly malleable. When present to the extent of 1 per cent. or upwards, tin materially lessens the ductility of copper. The factor of ratio of tin in reducing the electrical conductivity of copper is 67.

Zinc, as an impurity in copper, causes trouble in smelting, though not a highly deleterious impurity in the final product. When present in copper, to the extent of 0.2 per cent., zinc causes the sheets to crack at the edges when rolled, and in considerable quantities lessens ductility. The factor of ratio of zinc in reducing the electrical conductivity of copper is 30.

The great bulk of the world's copper production, with the exception of the Lake Superior output, is refined electrolytically. The principal advantages of electrolytic refining are that gold and silver values contained in the blister copper are saved, practically intact, while the product of the electrolytic refineries is a copper of unusual purity. The principle of electrolysis, or the parting of metals and the redeposition of one selected metal by the aid of a continuous electric current, was discovered in 1835, by Michael Faraday. As early as 1836 Becquerel planned works for the electrolytic recovery of copper and silver, but, owing to the prohibitive cost, the effort was abandoned. The first patents relating to electrolytic refining were taken out by Elkinton, of Birmingham, in 1865 and 1869, and in 1870 a plant was built at Swansea to utilize this process. A little later several small electrolytic refineries were built in Germany and France, and in 1879 the first American refinery to use electrolysis was erected in Phoenixville, New Jersey, this being followed, in 1881, by the construction of the Balbach works, at Newark, New Jersey, the latter named plant being the first to do electrolytic refining of copper on a considerable commercial scale. Shortly after the construction of the Balbach works, new plants of considerable importance were built in both France and Germany, followed, at a slightly later date, by the construction of new electrolytic plants in England and Wales. Previous to the opening of the great Boston & Montana electrolytic plant, at Great Falls, Montana, in 1893, electrolytic copper was produced mainly in Europe, but America now furnishes more than half of the electrolytic copper production of the world, doing electrolytic refining of blister copper from South America and Australia, as well as from the United States, Canada and Mexico.

Considerable secrecy regarding processes is maintained at many electrolytic refineries, but while the practice varies at different plants, the fundamental principles are the same in all works, and are understood by all competent operators. There are two principal systems of electrolytic refin-

ing, with numerous minor modifications. The series system uses rolled sheets, requiring a special rolling mill, and has electrodes in series and tanks in series, or, more frequently, in multiple series. The multiple system uses cast anode plates of 1 to 2.5 inches thickness, requires a much smaller electromotive force than the series system, and is in much more general use.

The tanks in which the process of electrolytic segregation and redeposition is carried on may be of wood, lead or slate, usually the former, though lead seems preferable. The wooden tanks usually are lined with lead, tarred felt or asphalt. The tanks may be set upon the floor, usually of cement, or may be sunk, leaving the tops about flush with the floor, to permit easier handling of the material. Tanks are terraced, in series, providing for a natural circulation of the electrolyte, which is pumped into the upper tanks and flows thence, by gravity, from tank to tank, until the bottom terrace is reached, when again pumped to the upper tanks. The Baltimore refinery uses tanks 9x2x2.5 feet in size, containing 130 electrodes of two plates each, giving a total weight of 5,700 pounds of charge, the process being carried on at a temperature of 20° Centigrade, with a power cost of about twenty dollars per horsepower year.

Connections between dynamos and tanks are made of high conductivity copper, necessarily of large size, to carry the heavy current used, and are of varying forms in cross-section, overlapping slabs of high conductivity copper being used at some plants.

The crude copper, mainly blister copper produced by bessemer conversion, may reach the works already cast in anodes, but usually arrives in pigs, and the anode bars usually are cast from blister copper melted in a cupola furnace, kept running for the purpose, and are cast in a variety of forms, usually in thin plates with projecting lugs that rest on the sides of the tanks, one lug resting on the electrical conductor, while the other is insulated. Lugs of anodes and cathodes vary in width, permitting each to make direct contact with the poles. The average American anodes average 98 to 99.5 per cent. in copper tenor, and the auriferous and argentiferous varieties carry up to 40 ounces gold and 300 ounces silver per short ton, with from a trace to 2 per cent. arsenic, and with variable quantities, usually small, of iron, nickel, antimony, bismuth, sulphur, silicon, selenium and tellurium, and with occasional minor impurities. After the process of electrolysis has been carried on until the anodes, usually rectangular in form, are worn down to about 15 per cent. of their original weight, the remaining portions are removed, melted down and recast.

The composition of the electrolyte, which is the fluid in which the process of electrolysis is carried on, varies at different works, carrying 5 to 10 per cent. sulphuric acid and 15 to 20 per cent. bluestone, added to 70 to 80 parts of water. The average composition is 6 to 9 parts of acid and 16 to 18 part of bluestone. It is desirable that the electrolyte have a sufficiently high percentage of sulphuric acid to render its specific resistance very low. The electrolyte frequently carries a very small percentage, as low as one part in two hundred millions, of some soluble chloride, usually sodium chloride, for the purpose of precipitating silver in chloride form, sodium chloride also tending to slime antimony in the form of an oxychloride. When the electrolyte becomes too foul for satisfactory use it is purified,

brought up to the proper standard and pumped back into use. Purification usually is accomplished by working up, at regular intervals, a certain quantity of electrolyte into bluestone, and adding fresh acid. The solution deteriorates more rapidly at the higher temperatures and the low current densities, apparently in direct ratio to anode loss and cathode gain. Nickel sulphides go into the electrolyte to some extent from nickeliferous copper anodes, and arsenic also passes into the electrolyte to a considerable degree, causing trouble in elimination. The easiest method of eliminating arsenic is to reduce the electrolyte to bluestone before purification.

In the process of electrolysis metals are dissolved at the negative pole of a battery, taken into solution in the electrolyte and redeposited from the electroylte at the positive pole, where free circulation is permitted in a favorable solution, with a proper electric current. Varying currents give varying effects, and some metals pass over more freely than others, copper being one of the first to pass over. Apparently the impure metallic copper of the anode is first broken into cuprous sulphate, from which are derived the molecules of practically pure metal that are deposited on the cathodes. In actual work there is a slight redissolution of the metal from the cathode, but this is not of sufficient extent to prove seriously detrimental. Good adherent copper can be obtained on the cathodes at almost any current density, providing there is a sufficient rate of circulation of the electrolyte. Current density is employed up to 3.5 amperes per square decimeter, but the usual ratio is a current density of 14 amperes per square foot, at a temperature of 50° Centigrade. As the unrefined copper in the anodes concontains a variety of metals and metalloids, it is important that the electrical current be so regulated that the minimum of other elements pass over to the cathodes at the same time as the copper. The adjustment of the varying factors of composition and circulation of the electrolyte, current density and temperature, call for nice discrimination, to be secured only by experience and care. The matter of temperature is one of prime importance, as the cost of power decreases with rising temperature, within certain limits, and the heating of the electrolyte not only facilitates the process of decomposition, circulation and redeposition, but produces also a smoother deposit of copper on the cathodes. Covered tanks are used extensively, to increase the temperature at which the work is done, and the best results seem to be secured at a temperature of about 70° Centigrade, equal to 158° Fahrenheit.

The cathode plates are made of strips of rolled copper, of one-eighth to one-fourth inch thickness, cut into varying sizes and forms, though usually rectangular. The cathode plates are oiled and coated with fine graphite, to promote deposition, and sometimes have lead lugs soldered onto them for handling.

While the copper and minute quantities of other impurities pass over to the cathodes, the great bulk of the impurities contained originally in the anodes is first taken into circulation in the electrolyte, and then precipitated to the bottom of the tank, as sludge or slimes. If more than traces of impurities are carried over to the cathodes it is because the electrolyte has become foul, or the current is wrong. Constant watchfulness is necessary, as apparently slight causes may bring about serious disarrangements of the process, at any point. The sludge precipitated to the

bottom of the tank may form a conductor, causing short-circuiting, and should be removed frequently, as large accumulations are reasonably certain to cause trouble.

An average anode slime runs about 40 per cent. silver, 25 per cent. copper and 2 per cent. gold, with about 10 per cent. arsenic, antimony and bismuth, the combined balance consisting of lead, silicon, sulphuric acid and minor impurities. The slimes contain greatly varying percentages of gold and silver, according to the nature of the copper treated. Slimes are removed from the bottoms of the tanks by bailing, or siphoning, and are taken to the slime-tank, where the copper scraps are picked out by hand. At some plants the slimes are put through a filter press and dried, though this is not customary. Slimes are treated generally with sulphuric acid and sodium nitrate, air and steam being admitted for agitation and heating. The copper is dissolved very readily as cuprous sulphate, by treating with ferric sulphate, and is recovered as bluestone. The arsenic also is removed by treatment with sulphuric acid and sodium nitrate, and after the removal of the copper and arsenic the remaining material is dried and smelted with soda, to slag the antimony, the impurities being oxidized by the nitrate. The doré bullion produced by this process usually is parted with sulphuric acid, but sometimes is parted mechanically, with a silver nitrate bath. Tellurium requires prolonged furnace treatment for burning off, though not especially difficult of elimination, if sufficient time is taken. Both selenium and tellurium, especially the latter, could easily be recovered from the slimes, if there were sufficient market to take the considerable quantities of these rare elements that could be furnished by the electrolytic refineries.

The process of electrolytic refining necessarily is continuous, two to four weeks being the average time required for the making of a cathode. Including time required for remelting and for other purposes, five to six weeks usually are required for the making of finished cathodes from rough copper, though much better time has been made under exceptionally favorable circumstances. The rate of progress depends quite largely upon the nature of the anodes, the process of electrolysis being greatly facilitated and cheapened by comparatively pure anodes. Mechanical devices have reduced greatly the number of workmen required about a well-quipped electrolytic plant, and have obviated most of the heavy manual labor required formerly. Traveling cranes and overhead trolleys provide expeditious means of handling both anodes and cathodes, and the electrolyte is handled by pumping, while as a rule the slimes are taken from the tanks by siphons, rather than by the old process of hand-bailing.

The cathodes produced by electrolytic refining average 99.93 to 99.9 per cent. in copper tenor, hydrogen being the chief impurity. The objectionable impurities are those that decrease electrical conductivity or render the metal brittle, the principal impurities to be guarded against being arsenic and antimony, which decrease conductivity, and lead and tellurium, which cause brittleness. Antimony and bismuth are seldom present in sufficient quantities to cause injury. The impurities in electrolytic copper usually include silver, to the extent of one-tenth to one ounce per ton, and a trace of gold, but these impurities are in nowise deleterious, though representing a loss to the refiner. Most copper ores contain silver, and the majority contain gold, in varying quantities, the copper mines of Utah being

richer in gold than those of any other American state, followed in turn by Arizona and California. In silver, the copper mines of Montana lead, followed closely by Utah, and, at a little distance, by California and Arizona. The immense importance of the precious metals obtained as by-products from the electrolytic refining of copper is shown by the figures of such production from American copper mines in 1904, amounting to 237,116 ounces of gold and 15,769,327 ounces of silver.

Electrolytic copper is in very minute crystals, while Lake copper is in crystals of considerable size, this difference in the size of the crystals being readily apparent to the naked eye on fractured faces. The larger crystals apparently are responsible for the superior tensile and torsional strength and ductility of Lake copper, but the toughness of Lake copper disappears under electrolytic refining, the product varying in no essential particular from all other electrolytic coppers, which come out of the bath as like as peas from a pod.

The cost of electrolytic refining varies from $8 to $20 per ton, according to circumstances. Unlike smelting, which usually best can be done near the mines, to save excessive freight charges on worthless material, elecrolytic refining is performed, in most cases, nearer to consumer than to producer. The extra freight paid on one to four per cent. of impurities contained in blister copper is so very small a fraction of the total transportation charges that this loss is more than offset by the advantages of cheaper labor, cheaper fuel and better transportation facilities found along the Atlantic seaboard in the United States, where a considerable amount of foreign copper is refined, as well as the bulk of the domestic production.

CHAPTER IX.

The Alloys of Copper.

The work of alloying the metals is a special branch of the metallurgical art, requiring much technical skill and experience, owing to the different melting points of the component metals, and their different capacities of oxidation and volatilization. Insufficient heat causes segregation of the different constituents, in the case of many alloys.

Zinc is the metal most commonly alloyed with copper, the product being brass. The proportions of the two metals vary greatly, ranging up to equal quantities, in the case of very high brass. Ordinary high brass is composed of two parts copper and one part zinc, and is of a light yellow color. Low brass ranges from 75 to 88 per cent. copper and 12 to 25 per cent. zinc, and is considerably ruddier in color than high brass. The addition of lead, to a small extent, usually not exceeding 5 per cent., gives an improved color to brass, and renders the metal more suitable to machining, as well as slightly reducing the cost. Ordinary commercial brass frequently contains 2 to 5 per cent. tin, which gives added strength and density. There also are special brass alloys containing lead, aluminum and manganese, in addition to copper and zinc. Brass is a much poorer conductor of heat and electricity than copper, and is more easily fusible.

Tin is mixed with copper in a variety of proportions, giving a considerable range of bronzes, with rather remarkable variations in their physical characteristics. Bronze probably is the most ancient alloy known to man. An alloy of 97 per cent. copper with 3 per cent. tin, practically a bronze, makes good sheathing metal. A small quantity of tin added to copper causes it to become brittle, but the ductility can be restored, at least partially, by heating to a cherry red, and cooling suddenly. Ancient bronze for tools and weapons ranges from 85 to 92 per cent. copper and 8 to 15 per cent. tin. Ancient bronze medals carry 8 to 12 per cent. tin. Ancient bronze mirrors contain 20 to 30 per cent. tin. Flexible bronze contains about 95 per cent. copper and 5 per cent. tin. Gun metal ranges 90 to 91 per cent. copper and 9 to 10 per cent. tin, and if the percentage of copper is increased the gun metal becomes liable to liquation. Bell-metal contains 80 to 84 per cent. copper and 16 to 20 per cent. tin. This is highly sonorous, when cast in bells, and makes good castings, but is decidedly hard, brittle, and difficult to work. Sudden cooling reduces the brittleness and restores the hardness. Bell metal is malleable at a low heat and can be forged, if handled very carefully. Speculum metal contains about 75 per cent. copper and 25 per cent. tin, and is harder and whiter than bell metal, and even more brittle and difficult to work.

Brass-bronzes are used for a variety of purposes, and for certain specific uses alloys composed of copper, tin and zinc are preferable to either brass or bronze. Bearing brass is much harder than common brass, and contains 80 to 82 per cent. copper, 10 to 14 per cent. tin and 2 to 4 per cent. zinc, being a brass-bronze rather than a brass. A cheaper and less efficient

bearing brass contains a smaller percentage of copper and a greater proportion of zinc. Muntz's metal is brass containing 60 to 62 per cent. copper and 38 to 40 per cent. zinc, and commonly carries about 0.2 per cent. in iron, nickel, tin, arsenic, or manganese, usually as a combination of several of these elements. There are a number of proprietary anti-friction metals having copper as a base, with varying proportions of tin and zinc, these being as a rule more closely allied to bronze than to brass, though a cross between the two metals.

Aluminum is the base of a number of important copper alloys, and the tensile strength and ductility of aluminum wire are much improved by the addition of as little as 1.5 per cent. copper. Aluminum bronze is a bronze containing about 3 per cent. aluminum, used largely for water-tube boilers. Several varieties of aluminum bronzes show high tensile strength, and an alloy of 96 per cent. copper and 2 per cent. aluminum gives a strong and fairly rigid metal. Albradium is an alloy having aluminum for its base, with the addition of copper, nickel, zinc and phosphorus. This alloy takes a very high polish and has good tensile strength. Aluminum alloyed with small quantities of nickel and copper has shown a tensile strength of 40,000 pounds per square inch.

Nickel copper, containing 2 to 3 per cent. nickel, is harder and of higher tensile strength than pure copper, but should not contain more than traces of lead or antimony. Monell metal is a natural alloy of copper and nickel, made from the nickel-copper ores of the Sudbury district. German silver is an alloy of 5 parts copper, two parts zinc and one part nickel.

Steel has been alloyed with nickel and copper, the latter to the extent of about 0.5 per cent., for the facing of compound armor plate, and this metal is said to resist corrosion as well as wrought iron.

Manganese, to the extent of 2 to 3 per cent., alloyed with copper, gives a product that is harder and of higher tensile strength than pure copper, if containing no more than traces of lead and antimony.

Arsenic alloys readily with copper, such alloys offering phenomena that are not fully explained by the chemical and metallurgical knowledge of the present day. Alloys of copper and arsenic are known usually as blanched copper, or speiss. Arsenical copper should contain at least three times as much arsenic as lead and bismuth combined, but should not exceed 0.6 per cent. arsenic, unless it be considered an alloy. Experiments on binary alloys of copper and arsenic show that arsenic lowers the melting point, down to about 20 per cent. arsenic, reaching the lowest point of fusion at 685° Centigrade, with an alloy of 19.2 per cent. arsenic, corresponding to the formula Cu_5As. With increase of arsenic the fusion point is raised to 747°. Centigrade with 28.34 per cent. arsenic, which corresponds to the empirical formula Cu_3As, and to 810° Centigrade with 32.2 per cent. arsenic, corresponding to the formula Cu_8As_2, an alloy with 37.4 per cent. arsenic giving the formula Cu_2As. The practical limit of the direct binary compound of copper and arsenic was reached with 41 per cent. arsenic, corresponding to the formula Cu_7As_4. The alloy of 19.2 per cent. arsenic gave a surface of pale blue color, the alloy of 28.34 per cent. gave a deep blue, 30 per cent. gave light purple, and 32.2 per cent. gave a reddish purple color to the surface of the alloy.

Mercury alloys with copper in the proportion of three parts of copper

to seven parts of mercury, making a copper amalgam known as Viennese metal cement.

Phosphorus, in small quantities, renders copper considerably harder than when pure. Phosphorus copper should contain 99.7 per cent. to 99.8 per copper, 0.05 to 0.1 per cent. phosphorus, and not more than 0.04 per cent. oxygen.

Strontium and tungsten, in small quantities, alloyed with brass, give a golden metal of great tensile strength, strongly resistant to atmospheric influences. The alloy contains 60.8 per cent. copper, 37.6 per cent. zinc, 0.4 per cent. tin, 0.3 per cent. strontium, 0.3 per cent. tungsten, 0.3 per cent. aluminum, 0.2 per cent. manganese and 0.1 per cent. iron.

Tellurium, in small quantities, renders copper of wonderful hardness, though also causing it to become red-short, having much the same influence on the metal as arsenic, but to an intensified degree.

Gold and silver are alloyed with copper for coinage purposes, and for trial plates and medals.

Imitation gold, bearing a striking resemblance to the real article, is made by an alloy of copper, tin, nickel, silver and aluminum.

CHAPTER X.

THE BRANDS AND GRADES OF COPPER.

Copper is placed on the market in a variety of grades and shapes, descriptions of which are appended.

Lake copper is the product of the native copper mines of Lake Superior. Lake copper varies greatly in characteristics, and materially in price, the Calumet & Hecla brand being nearly as free from impurities as the best electrolytic copper, while the Copper Range metal is highly arsenical, and between these grades there is a great variety of brands made by different mines. The lake copper is the toughest that is made, hence is especially suitable for wire-drawing or cold-stamping. The best brands of lake copper command a premium over electrolytic, this varying from time to time, but averaging about one-eighth cent per pound. The standard of conductivity of lake copper is 99.5, but there is a considerable range of conductivity among the various brands, this running as low as 91 per cent. in Wolverine copper and as high as 101 per cent. in the metal from the Quincy and Michigan mines. Lake copper possesses greater tensile and torsional strength than is found in other brands. In addition to the domestic market, lake copper finds a limited but steady demand in Europe, for all uses where copper of special toughness is required, as in the making of cartridge cases, metallic buttons, etc.

Electrolytic copper is copper from any source that has been refined electrolytically, and the cathodes average about 99.93 per cent. fine. Copper made by this process is the purest chemically that is on the market, and is the best conductor of electricity, having conductivity up to 103, but lacks the toughness of lake copper, hence is not so suitable for wire-drawing or cold-stamping, but for some other uses is preferable, and for most purposes there is little choice between lake and electrolytic.

Approved brands of copper are those that have been approved by the London metal market, and include practically everything that would pass as standard copper.

Best selected copper averages about 99.75 per cent. fine, and is used largely by brass foundries for making brass castings, rolling brass sheets and drawing brass tubes.

Tough cake is practically the same as best selected copper in the English market, prices being the same, and is used mainly for rolling and for tube and cylinder making. The average tenor is about 99 per cent. copper, and this grade usually contains a little lead, which is no particular detriment for the uses noted.

Tough copper is practically the same as tough cake, and is used for wires and sheets.

Ingot copper is rated in the English market with tough cake, and is practically selected copper.

G. M. B. copper is the usual abbreviation for good merchantable brands.

Good merchantable brands of copper, a term formerly used extensively in the English market, is now generally known as standard copper. The

old title was so misused that it deteriorated sadly, and became very indefinite, in time including almost anything that could be called copper.

Chili bars are bars of blister copper from Chile ranging 95 to 99 per cent. in copper tenor. The term is in much less general use than formerly, and most of the Chili bars are sold as standard copper.

Standard copper covers almost anything carrying 96 per cent. copper, and includes considerable metal that is decidedly inferior, much of it containing very undesirable impurities. The price ranges two to three pounds sterling per ton under the market price of tough copper. The average tenor of standard copper probably is about 97 per cent. Standard copper is more a standard for speculation, in the metal market, than a grade for actual consumption, as most of the low-grade copper included under this name is used either as casting copper, or is brought up to high grade by electrolytic refining.

Rough copper is practically the same as standard copper.

Casting copper is rough metal, not suitable for the manufacture of wires or sheets, containing considerable impurities of a serious nature, being suitable only for casting purposes.

Tile copper is brittle, and is suitable for casting only, hence usually is graded as casting copper, in the English market.

Scrap copper is the remnants from the manufacture of sheets, wire, etc., and is of good average grade, though in undesirable form, but can be melted down into cakes or ingots.

Copper is placed on the market in a variety of forms, which are listed as follows:

Ingots are cast in two sizes, the standard weight being about 60 pounds avoirdupois. Copper is put up in this form mainly for casting purposes, the two deep depressions in the top of the ingot being provided to facilitate the cuting of the ingot into three parts.

Wire bars are cast 3 to 4 inches square and 3 to 7 feet in length, averaging in weight 300 to 400 pounds, and, as the name implies, are used for wire-drawing.

Cakes are cast square, in weights of 100 pounds or upwards, some special cakes for the Russian market weighing as high as 4,000 pounds each. Copper in this form is used almost exclusively for rolling into sheets.

Moulds are somewhat similar to cakes, and are used mainly for rolling into sheets.

Anodes are cast in plates about 2 by 3 feet in size, and have an average thickness of about 1½ inches, with an average weight of about 250 pounds. Crude copper from the furnaces is cast into anodes for electrolytic refining.

Cathodes are of approximately the same size as anodes, except that they are much thicker at the top than at the bottom, and while the copper contained is exceptionally pure, it is in crystalline form, and the cathodes are melted down and run into other shapes, cathodes rarely appearing on the finished copper market.

Flat bottoms are circular copper sheets, used for making copper boilers, pans, etc., and in the English market command a slight premium by reason of being partially manufactured shapes.

Sheet copper is cold-rolled metal, and commands a premium by reason of being partially manufactured.

Sheathing copper is hot-rolled metal, and, like sheets and bottoms, commands a premium over ordinary brands by reason of being partially manufactured.

The various alloys of copper, some of which are of considerable commercial importance, are treated in the preceding chapter, devoted to alloys.

Tempered copper is a will-o-the-wisp that is referred to frequently. Many inventors, usually poorly equipped with technical skill, have wasted much time in efforts to rediscover the "lost art" of tempering copper, and, on an average of once yearly, the American press contains long articles giving hazy details of a rediscovery of the process of tempering copper to the hardness of steel, such wonderful discoveries usually being made by blacksmiths in Maine, cobblers in Pennsylvania, farm-hands in Illinois or cow-punchers in Texas. A typical example of one of these processes is furnished by a lady in the state of Washington, who puts a razor edge on copper tools by adding an ounce of bluestone to a hundred pounds of copper, while molten, and, if an especially fine edge is desired, an ounce of bichromate of potash is added to the charge. The lady inventor evidently is a homœopathic metallurgist. It is doubtful if the mound-builders of America possessed any special art of tempering copper, as it has not been proven that the copper tools of the ancients were harder than those made from modern copper. If tempered copper were greatly to be desired, it is probable that it might be furnished with the aid of tellurium, a small quantity of which renders copper exceedingly hard, but as tempered copper merely would replace steel, in most instances, and as steel is very much the cheaper of the two metals, a perfect process for tempering copper seems unnecessary.

CHAPTER XI.

THE USES OF COPPER.

Iron, copper and zinc are the three indispensable metals of the present age. The loss of tin, or lead or even of nickel or aluminum would be a severe blow, working great hardship, and, even were we to be deprived of such apparently insignificant metals as antimony, cobalt, manganese and platinum, the industrial world would suffer a loss entailing disastrous consequences. The taking away of gold and silver, and that useful thief-taker, mercury, which catches most of the world's gold supply, would reduce the finances of the globe to chaos. Iron and copper, however, are the main pillars of the metallic structure, while zinc, in addition to many other virtues, possesses the unique quality of being the only electrically negative metal, and, without it, copper, for electrical uses, would be much like a "pair" of scissors with but a single blade.

Many great industries are dependent upon the metal copper, which, directly and indirectly, affords employment of some hundreds of thousands of persons, mainly skilled workmen, and adds nearly or quite five hundreds of millions of dollars yearly to the wealth of the world. Copper is nearly as indestructible as the precious metals, and its life is infinitely longer than that of iron or steel, as has been brought to attention by more than one archæological discovery, in which bronze weapons or implements were practically intact, while those of iron or steel were represented merely by streaks of rust.

The engineering trades take nearly half of the total copper production of the world, and, until about 1890, used nearly or quite four-fifths of the entire output of this metal. Since that time has been witnessed the wonderful development of the various branches of the electric industry, and, at the present time, electricity, in some of its various forms of energy, is the largest single user of the metal, with every indication that the electrical requirements of the future will continue to expand, almost indefinitely.

Electrical machinery, as dynamos or motors, is a heavy consumer of copper and brass, but the principal consumption of copper for electrical uses is in the form of wire, for the transmission of energy to be used for power, traction and lighting, and for the electrical impulses providing the conveyance of messages. Copper is an integral factor of prime importance in all electric installations, and for the transmission of power, light and telegraphic or telephonic impulses, is a necessity. It is true that iron wires were used by the pioneers in the telegraphic and telephonic fields, but these are giving way rapidly to strands of copper. Iron is of low electrical conductivity, rendering it an inefficient and costly medium for transmission, and its lack of ductility, and the ease with which it is rusted, render it far less desirable than copper, though it is used at times because of its greater cheapness.

The life of copper wire is as yet undetermined. When laid under-

ground it is affected by electrolysis, but to nothing like the same extent as iron, and copper wire, in the atmosphere, while undergoing some surface oxidation from carbon dioxide and sulphur vapors, is but slightly affected thereby.

The trolley line of the present day, threading its way through the mazes of every city and town of any importance, and weaving a spider's web over most of the thickly populated sections of the United States, is a strictly modern affair, and may be said to date from about 1890, the earlier lines having been few in number, short in length, and of an experimental and usually unsatisfactory nature. At the end of 1906 there were upwards of 40,000 miles of trolley lines in the United States, requiring upwards of 40,000 tons of copper for power transmission alone. The average weight, in that year, of trolley wire in the United States, was 1,688 pounds per mile for short lines and 2,687 pounds per mile for long-distance power lines on interurban and well-equipped city roads. The trolley line is as yet in its infancy, and the time will come, unless some superior means of traction shall be invented later, when the United States alone will have more than a million miles of electric roads, wild as this prediction may sound at the beginning of the Twentieth Century. Furthermore, the trolley line must grow more popular in all other countries. The United States has led in the electrification of transportation lines, but the cities of Europe are now possessed, in most cases, of modern electric street railways, and it is but a question of time when interurban lines will supplement urban transportation facilities in Europe, as they now do in the United States.

In addition to the large quantities of copper required for power transmission lines, the metal is used very extensively in the motors of the cars themselves. The weight of copper in a street railway car ranges from a minimum of about 250 pounds to a maximum of nearly one ton, a forty horse-power trolley-car motor containing an average of about 800 pounds of the metal.

The electrification of steam railroads has been discussed academically since the trolley-car first became a factor of importance in the field of transportation. The work of electrifying the steam lines has proceeded but slowly, much to the disappointment of many urgent advocates of such a change, but the reasons for this slowness are not difficult to find. Thousands of millions of dollars have been invested in steam railroads, in the United States alone, and it would be folly, or worse, for those in charge of these lines to discard an old and proven motive force for a newer power, until the latter had demonstrated fully its ability to do the work more cheaply and advantageously.

In the war now on between the steam roads and trolley lines, for urban and suburban passenger business, the trolleys have had very much the better of the battle, and are now forcing the fight into the country of the enemy, by means of linking together various interurban lines, through which plan long stretches of road have been brought into single systems. On some of these lines dining and sleeping cars have been introduced, but the latter seem to be more in the nature of an advertisement, or a boast, than for practical use. The steam locomotive and the electric trolley-car have been running side by side for a sufficient length of time,

in a sufficient number of fields, to afford fair basis for comparison, and a dispassionate survey of both fields leads to the conclusion that neither is supreme, and that, for at least many years to come, the steam locomotive will hold its own, on many lines. Each method of traction has its advantages and disadvantages. It is possible to build an electric motor that will compete with any steam locomotive, as to speed and tractive power, but this would require feeding from a much heavier wire than now in use on any trolley line. For long hauls and great speed between distant points, the trolley cannot yet be held a serious competitor of the steam locomotive, while for short distances, immediate access to centers of population, and frequency of trips, the electric line has proven its great superiority to the steam road.

Electrification of tunnels and terminals has been undertaken by a number of railroads, and electric traction offers so many points of superiority for these special uses that it is certain to dispossess the steam locomotive, in the majority of cases.

It is now possible to distribute electric energy for great distances, without serious impairment or waste, and it would be folly to attempt to set a limit to the future possibilities in this field. Eventually it may be found practicable to transmit electric energy from great central stations, located at available water-powers, or in coal-fields, along many hundreds and even thousands of miles of railway line, and when that time arrives, the steam locomotive will have met its Waterloo. That steam ultimately will be displaced by electric power, in many, and probably in the majority of cases, may be accepted as a reasonable probability, but this process will be gradual, and due allowance must be made for the influence of future inventions, which may give an entirely new phase to the situation. It should be borne in mind, in this connection, that the past decade has witnessed some marvelous developments in the production of power, entirely outside of the electrical field, these including the perfection of the turbine steam-engine, great improvements in turbine water-wheels, the vast increase in scope and power of internal combustion engines, and the utilization of producer-gas. The prophet who attempts to peer too far into the future may strain his reputation, as well as his eyesight.

Hydro-electric power installations are becoming very common, throughout the world, and from these plants electric energy is distributed for distances of fifty to one hundred miles, and even for one hundred and fifty miles in the case of some of the later installations. In transmitting power for long distances, a high voltage is used, almost invariably, the current being stepped down at the point of utilization. Water power, which was the principal mechanical force of the world, one hundred years ago, but which fell into very general disuse about the middle of the Nineteenth Century, is coming into its own again, and where a stream was made to furnish a few hundred horse-power, by means of a wasteful overshot water-wheel, fifty or seventy-five years ago, the same stream now gives thousands of horse-power by means of the economical water turbine. The utilization of water power is revolutionizing the location of industries, which, for the past three generations, have been located near fuel supplies, or along the lines of least resistance in the distribution of fuel.

Electric lighting has ceased to be a novelty or a luxury, and is now

a necessity in every progressive community. There can be no question that eventually electric energy for both lighting and power purposes will be transmitted throughout the country, to such an extent that rural, as well as suburban populations, will benefit fully from its use. In 1902 the American Census Bureau reported 125,143 miles of main and feeder wires connected with electric lighting and power plants, and this network of wires must have reached nearly or quite 200,000 miles in 1907.

The telephone, invented in the last quarter of the Nineteenth Century, and not in general use until after 1880, is now found scattered throughout the length and breadth of every civilized land, and in many countries that only by a stretch of imagination could be termed more than semi-civilized. Greater New York alone possesses nearly a quarter of a million telephones. At the end of 1906 the various affiliated companies of the American Bell telephone system had in use about 375,000,000 pounds of copper wire, of which more than 50,000,000 pounds were added in 1906, the increase for that year having averaged almost exactly 1,000,000 pounds per week. In addition the thousands of smaller independent telephone systems throughout the country use tens of millions of pounds of copper wire yearly. At the beginning of 1907 the Bell system of the United States had in use sufficient wire to girdle the earth thirty-eight times, at the equator, if the wire were standardized to the size used for long-distance transmission. In addition to the requirements of the telephone companies for wire, the instruments themselves contain considerable brass, and modern desk-phones are made of brass, nickel-plated. Furthermore, an immense amount of copper is required for the big switchboards of the telephone companies, and the mammoth switchboards of the electric light, power and traction lines also are consumers of enormous quantities of the metal.

In the beginnings of telegraphy, iron wire, because of its lower cost, was used very generally, but the lower conductivity of iron, and its lack of ductility and proneness to break under stress of wind or sleet, renders iron wire, while cheaper in the first cost, much dearer in upkeep than copper, and the present tendency of the telegraph companies is to replace iron with copper wire, wherever possible, the greater initial cost being more than offset by the far greater life and assurance of good service given by copper. The various ocean telegraph cables, of which there are approximately 200,000 miles in use, require many thousands of tons of copper. The government cable, between the United States and the Philippine Islands, is 8,200 nautical miles in length and in making required 19,000,000 pounds of iron and steel wire, and 3,600,000 pounds of copper wire. In addition to the wires, all telegraph instruments are made of heavy brass, and copper sulphate is used in enormous quantities for batteries, furnishing power for the transmission of the electric impulses.

In addition to the power, light and traction lines, and the telegraphs and telephones, copper wire is used to the extent of millions of pounds for minor electrical systems, these including messenger call systems, fire-alarm systems and burglar-alarm systems for banks and private residences. These systems not only require much wire, but also are considerable consumers of brass for their annunciators and other instruments.

Electric heating and cooking are as yet in the experimental stage, to the extent that while their feasibility has been demonstrated, their

cost remains prohibitive, in most cases. It is probable, however, that further inventions will reduce the cost to a point where the electric current will come into quite general use, for these purposes. The immediate availability of the electric current, which may be turned on or off by the mere touch of a switch, has brought about the very general use of electric lighting, and will bring about as wide a use for cooking and heating purposes, as soon as the march of invention will permit the furnishing of the current at lesser cost, for such uses.

In addition to its use for the transmission of electrical impulses or energy, copper wire is utilized for other purposes, in a great number of industries, though the electric trades consume more than ninety-five per cent. of the copper wire that is drawn.

Brass, an alloy of copper and zinc, is one of the most useful metals known to man, being the most valuable of all alloys, and probably is consumed to a larger extent than all other alloys that are made. The engineering trades are the heaviest consumers of brass, and, notwithstanding the immense consumption of copper for electrical purposes, it is probable that the engineering trades remain the heaviest single consuming interest in the copper trade. Every modern steam engine has brass oil-cups, and many have brass, gun-metal, bronze or composition copper bearings. Copper and brass boiler-tubes are used in locomotives and other high-pressure boilers, and every locomotive requires a large amount of brass in its trimmings. Copper tubes are used almost exclusively in marine condensers.

The ship-building trade is one of the very best customers of the copper mines. Until the era of iron vessels, prudent ship-owners sheathed the hulls of their vessels with copper, which kept the bottoms clean, and within the past few years this practice has been renewed, with modern steel steamers, on which it is necessary to plank over the hull, below the water line, in order to give a backing for the riveting-on of the copper sheets. The loss in speed, and consequent loss in time and fuel, brought about by barnacles gathering on iron and steel bottoms, is very great, and this can be obviated only by dry-docking and scraping, at considerable expense and loss of time, or by copper-sheathing below the water-line, and the latter plan is considered the cheaper. In all likelihood some method will be devised, eventually, for the plating of copper directly on the steel bottoms of boats. Every modern passenger vessel and warship of great size is a consumer of hundreds of tons of copper, in the form of brass for engines, copper and bronze for fittings, copper and brass for dynamos and motors, and in wires for telephone, telegraph and electric light systems.

In the line of land transportation, the use of copper for roofing and sheathing passenger coaches of railroads is spreading. The underground railway cars in New York are sheathed throughout with copper, which proves more durable than wood, and this utilization of the metal is likely to increase steadily, as old-style cars of wooden frame give way to steel cars. The ideal passenger car of the future will have a steel frame, copper roofing and sheathing, wooden interior finish with brass fittings, and paper wheels.

Wherever there are waterworks, brass faucets and valves are found. The

consumption of brass for valves is enormous, and for very many uses these valves, while very costly in the larger sizes, prove economical in the end.

In the arts and manufactures, copper plays a highly important part. The great vacuum-pans of the sugar factories and refineries are made of copper, and there are copper vats in pulp and paper mills. The worms and stills of distilleries are of copper, and the copper brewing kettles in which beer is made are of immense size, and are numbered by thousands. There is scarcely a branch of manufacture that does not make use of copper or brass, usually to a considerable extent, in one or many of the various processes employed. In the textile trades, copper rolls for stamping patterns on print-cloths are consumers of hundreds of tons of the metal.

Perforated metal screens of brass and copper are in use in many industries, and these, while considerably higher in first cost than similar screens of iron, are more economical for many uses. Similarly, woven wire screens of brass are replacing steel wire-cloth for many uses, the first cost being higher, but the life much longer.

The automobile may be termed a strictly Twentieth Century invention, as the modern machines date from but a few years back, even though their forbears were seen, as a rarity, in the closing years of the previous cycle. An average automobile requires about 100 pounds of copper, mainly in the form of brass, for lamps, horns and other parts and accessories. The world's consumption of copper for automobiles probably reached nearly or quite ten million pounds in 1907.

The motor-boat is another Twentieth Century invention, even more recent than the automobile, and is gaining rapidly in popularity. These boats require from fifty to two hundred and fifty pounds of copper each, according to size.

In building construction, the uses of copper are extensive and increasing. Copper roofs for buildings, with the metal in either sheet or tile form, are quite common, and the use of copper for cornices is general, these having much longer life than cornices of galvanized iron. Copper is more costly, but its freedom from corrosion and its rich appearance render it desirable for ornamental trimmings and cornices on the better class of buildings. Bronze gates and doors for churches and public buildings are highly ornamental, and of practically perpetual life. Bronze grille work is in high favor, both for its rich appearance and its durability. In some recent buildings, copper sheets have been used almost exclusively for outside walls and facings, in place of brick or cut stone. The use of this metal for sheathing interior woodwork, where exposed, as in baseboards, window-sashes, doors, etc., is increasing. In the destruction of San Francisco, in April, 1906, through an earthquake shock, followed by fire, the Kohl building, an eleven-story office structure, suffered comparatively little damage, being the only tall building in the city that was not badly injured. In this building all interior woodwork was protected by sheet copper, and it was this protection that allowed the building to escape with the minimum of damage. This use of copper is certain to increase, as the severe trial imposed in San Francisco proved the value of metallic sheathing for interior wood finish, and architects and builders have been greatly impressed by the advantages of this feature of construction. The San

Francisco earthquake and fire also proved the great danger to pedestrians resulting from the use of concrete and terra cotta cornices. There is a growing use of copper for windows and sashes made from sheet metal, and one firm in Maine turns out over one million copper-wire window-screens yearly, these costing about three times the first price of steel woven wire, but proving cheaper to the user in the long run.

In builder's hardware, brass, bronze and copper locks, knobs, butts, bolts, catches and drawer-pulls are in steadily increasing favor and use, and because of the superior durability and appearance of copper and its alloys, will continue to displace iron to a greater extent, as wealth increases and the standard of living is raised. In modern office and apartment buildings and in hotels, the mailing chute, made of brass and glass, is becoming a necessity, rather than a luxury. There is a large consumption of high-grade brass pipes and castings for gasoliers and electroliers, which are rapidly displacing the crude and often semi-barbarous iron devices of the preceding generation. Brass pipes and faucets, usually nickeled, are used in the best plumbing, for bathrooms and lavatories, on both land and sea.

The domestic uses of copper and brass are numerous and varied. Brass beds and furniture attract by their cleanliness, beauty and durability. Brass rods are used in millions of homes for stair-carpets, and for the suspension of portieres and curtains. Brass or copper lamps for burning kerosene oil are more durable than those of glass and pottery, and far safer. In the kitchen, the brazen kettles of earlier days are losing ground; there is no better material in use for cooking, when carefully cleaned, and none that may cause so much trouble if neglected.

The use of copper, in the form of bronze, for statuary, dates from prehistoric times. The ancient Greeks used mainly Pentelican marble for statues, and terra cotta for statuettes, but the modern world makes its statues and bas-reliefs almost exclusively of bronze. Iron turns to rust, wood decays, and marble is mutilated and discolored, but bronze retains the beauty and finish imposed upon it by the sculptor, being subject to slight corrosion only, in the course of ages, when buried in the earth. For general decorative purposes bronze is much used for vases, urns and similar ornamental receptacles.

The best bells are of bronze, in which copper is the principal component. In addition to perhaps a million church bells, there is a considerably larger number of smaller bells, mainly made of brass, in use in practically every power plant, and in fire, burglar and messenger alarms.

Copper is used extensively for munitions of war, the largest single requirement being for cartridge cases, with small but appreciable quantities used for buttons, and for a variety of other uses. The brass cannon, so popular fifty years ago, are in the present age used mainly for firing salutes, ornamenting public squares and trading to the heathen. Notwithstanding this disuse of the metal for ordnance, except in small salute-guns for yachts, more copper is used now, for munitions of war, than ever was consumed in the casting of cannon. Brass and copper cartridge-cases, cold-stamped from tough sheets, are consumed annually, by the world's armies, to the extent of hundreds of millions, for machine guns and small arms, and to a scarcely smaller extent by hunters. Hundreds of tons of

the best tough metal are used annually, merely to make the brass buttons for decorating the uniforms of the world's armies and navies. Brass fittings and buckles for men and horses, brass canteens, drinking cups and cooking utensils, also require much copper for the followers of Mars, though aluminum, by reason of its superior lightness, is displacing copper for the smaller metallic articles required by troops. The copper exploders, used in every metal mine where modern methods are employed, afford another use, apparently trivial, yet which is one of the scores of minor demands that in the aggregate consume thousands of tons of copper yearly. The amount of the metal consumed by the world, for munitions of war, cannot be much short of ten thousand tons yearly, in times of peace, and several times as much in season of great wars.

Copper and its alloys have been employed for coinage from time immemorial. Originally copper was a purely money metal, like silver and gold, and each copper coin, unless debased by the short-sighted cunning of the petty tyrant, oligarchy or democracy of the day, represented upon its face merely the intrinsic value of the metal it contained. Eventually the inherent impossibility of keeping three separate metals upon any fixed basis of parity led to the relegation of copper to the status of token money, for the same reason that silver coins have been made merely token money, by the leading nations of the globe, during the past hundred years. The Chinese continued to give honest values in their brass money until 1904, when the possibility of debasing the coinage, to the great profit of the provincial officials, suggested itself so forcibly to the astute minds of some of the governors that several of the Chinese mints were worked with feverish activity, in turning out new copper cash, but, as invariably is the case in any debasement of coinage, the work was overdone, and much confusion and loss has been caused by the excessive issue of copper coins, in several of the provinces. In 1904 the four mints of Tientsin, Wuchang, Canton and Foochow, emitted 3,997,710 twenty-cash pieces, and 371,916,330 ten-cash pieces, consuming therefor 13,718 long tons of copper. The total amount of copper consumed for Chinese coinage, in the three years 1903 to 1905, inclusive, probably was between thirty thousand and forty thousand long tons, though possibly greater, and the coinage requirements of 1905 alone have been estimated as high as 59,000 long tons, but this, without question, is excessive. For the fiscal year 1906 the United States government consumed about 825,000 pounds of fine copper for coinage, this including the metal for bronze cents and the copper used for alloying gold and silver coins. The monetary systems of practically all civilized countries include the use of copper for the smaller coins. It is estimated that nearly £1,000,000 in copper coins is locked up, constantly, in the penny slot-machines extensively used in Great Britain for gas-meters, and for the automatic vending of many other articles. In the United States, France, Germany and many other countries, automatic vending machines are very common, and have necessitated, in all such countries, a considerable increase in the coinage of copper money, to maintain the supply of minor coins, so heavily drawn upon by the automatic machines.

Practically the entire works of a modern clock are made of brass, and in the case of the Yankee dollar clocks, now to be found in the most re-

mote corners of the earth, practically everything but the glass front and the hands are made of brass, though the case is nickeled. The gear wheels and pinions of watches, whether of the dollar variety or of the highest grade, are made from brass, and the dials of watches also are made of brass enameled. A single firm, in the Naugatuck valley of Connecticut, stamps out one hundred thousand watch dials daily, and buys Calumet & Hecla copper in lots of five to fifteen tons therefor.

Instruments of precision used in the scientific world are composed mainly of brass. Microscopes and telescopes, surveyor's transits and draughtsman's protractors, and hundreds of other strange instruments of marvelous variety and complexity, that do human work without the element of human fallibility, are composed almost exclusively of brass.

In ceramics, copper and cobalt, often found associated in nature, are the principal metals used for coloring, and an infinite variety of colors and shadings of the utmost delicacy are secured, in glassware and the higher grades of pottery, from the ores and compounds of these metals.

In the business world, the uses of copper are numerous. Signs of copper, brass and bronze stare at us from every corner of crowded city streets. Copper leaf is used by sign-writers, and in various other ways, and comminuted copper is used in bronzing. Brass rods are utilized for window displays and in various mechanisms used for exhibiting goods in retail business houses.

In offices and for clerical work, copper is consumed to an extent far beyond the wildest guess of anyone who has not given thought to the subject. Brass platens are used on typewriters, for heavy manifolding, and the best numbering and dating machines have their figures cut upon brass wheels, and brass is used in other parts of such devices. Brass wire for stapling papers is consumed extensively, as are brass paper fasteners, and the little brass clips, so easily attached to or detached from masses of papers, are used by the hundreds of millions yearly, a single set of files, of the dozen or more required by the Copper Handbook, consuming about fifteen thousand such clips in every year. Hundreds of tons of copper are consumed in the manufacture of metal tips for lead pencils, these being almost invariably of brass, with a thin plating of nickel, and for metallic tips for penholders, metallic pencilholders and miscellaneous office devices and fittings.

Practically all of the high grade American toilet preparations now are put out in glass bottles, or nickeled cans. These cans, formerly of tin, now are almost invariably of brass and copper, lightly plated with nickel. A single manufacturer of talcum powder alone used more than six million small cans for his product, in 1906.

Several thousand tons of copper are consumed yearly, in the United States alone, for the manufacture of so small but necessary an article as the pin.

A single Connecticut firm uses an average of about twelve thousand pounds of copper daily for making eyelets, bals and vamps for shoes.

Brass mountings are used extensively in the manufacture of harness for horses, either appearing in the natural color, or plated with nickel silver or gold. Copper is used frequently for card cases, cigarette cases and for mounting ladies' fine pocketbooks, wrist-bags, and chatelaine-

either appearing as the natural metal, or plated. Copper is used also, to a large extent, for the heads of umbrellas and canes, and is used frequently for backing combs, brushes and mirrors.

The use of copper for ornaments is very general among all savage tribes where the metal is available, either through aboriginal production or by reason of purchase from traders. Copper wires, made from ore smelted in crude furnaces, and drawn through stone mandrels, are found in Central Africa, in the vicinity of Lake Tanganyika, and are used extensively for arm and leg bracelets, ear-rings, nose-pieces and other embellishments for the person of the untutored savage. The dark-skinned Hindoo, and the darker-skinned native of Central and Southern Africa, evince one failing in common, this being a great fondness for jewelry and ornaments made from telephone and telegraph wires, but when these are succeeded, as is commonly the case, by high voltage power transmission lines, such depredations cease, after about the third consecutive funeral. Some of the telegraph and telephone companies, operating in districts where natives are unduly fond of copper wire, have found it necessary to protect their wires by currents of sufficient voltage to give severe shocks, without causing death to wire thieves.

The uses of copper enumerated in the preceding paragraphs of this chapter are for the metal and its alloys, brass and bronze. There are other alloys, not previously mentioned, such as nickel-copper, arsenic-copper, aluminum-copper and others, that are used for a variety of special purposes.

Malachite, the green carbonate ore of copper, when found massive, is a semi-precious stone of great beauty, and is much in demand for table tops and interior architecture, and also is an exceedingly beautiful stone for brooches, pins and buttons. Chrysocolla, a silicate of copper, vies with malachite in beauty and utility, and turquoise owes its beautiful blue color to the small amount of copper contained therein. Other ores of copper are ground up for pigments, many beautiful shades, especially blue and green, being secured from mixtures having copper ores as bases.

The most important copper mineral, for other uses than the production of metal therefrom, is copper sulphate, the common bluestone or blue vitrol of commerce. This is found in nature as chalcanthite, but, as a rule, is a product of manufacture. This compound is one of the most important chemical agents known to science and the arts, and is a necessity in the electrolytic refining of crude copper. It is a component part of all wet batteries, and, as such, rings our door-bells, carries our telegrams, and is the energizing agent that permits the transmission of the human voice over the wires of the telephone. In electroplating, electrotyping and kindred industries, it is the prime factor. As an insectide it stands without an equal, dilute solutions of sulphate of copper having stayed the ravages of the phylloxera, when the vineyards of France seemed doomed. It is probable that not less than one hundred thousand tons of copper sulphate, containing a quarter of its weight in metallic copper, are consumed yearly in spraying the vines and fruit trees of Europe and America, and thus it may be said that it is to copper that we owe the sparkling wines of France, the peerless American apple and the blushing peach that reaches perfection on every continent.

The consumption of sulphate of copper is not confined to horticulture and the electrical industries, as it is used, to the extent of thousands of tons monthly, in the textile factories, in the chemical industries and in manufactures of greatly varied lines. Bluestone, for the past few years, has found a new and valuable use, as a destructive agent in eliminating the algæ from domestic water supplies, and it is asserted, apparently with reason, that the typhoid fever germ is destroyed by adding bluestone to water in the proportion of one to ten millions. A bluestone solution of one to five hundred thousand is effective in killing the larvæ of mosquitos, when young.

During the Nineteenth Century the production and consumption of copper increased by more than forty-fold, and the end of the century found the metal used for nearly forty times as many purposes as were known one hundred years before. What another century may bring forth, no man can tell, but that the metal will be in strong demand, in ever-increasing quantities, for an ever-widening variety of uses, seems open to no doubt.

CHAPTER XII.

SUBSTITUTES FOR COPPER.

For many uses copper is unrivaled, while for other uses there are substitutes of greater or less utility that may become available under certain circumstances. The displacement of copper by other materials increases, in many lines, almost in direct ratio to the increase in price of copper, but while higher prices for the metal cause considerable substitution, lower prices invariably drive the substitutes, partly or entirely, out of the field.

In building construction, for making cornices and similar uses, galvanized iron is a cheap but not altogether satisfactory substitute for sheet copper. Iron remains a competitor of copper also in the wire trade, for telegraph and telephone lines, but owing to its low conductivity is not available for power transmission.

Copper wire laid underground, and not protected by tubing, is affected by electrolysis, but to nothing like the same extent as iron, and copper wire in the atmosphere undergoes some surface oxidation from carbon dioxide and sulphur vapors, but such oxidation is merely superficial. Apparently the life of a good copper wire, in ordinary use, is of indefinite and practically everlasting duration. Iron is low in electrical conductivity, rendering iron wires an inefficient and costly medium for the transmission of electrical impulses, and out of the question for the transmission of electrical energy. Iron also is subject to rust, and its lack of the ductility that is such a strong characteristic of copper, causes iron wires to break from winds and sleets that would not injure lines of copper wire. Telegraph and telephone wires of iron remain in use to a much larger extent than generally supposed, owing to the cheap initial cost of installation, but the cost of maintenance and repairs renders it certain that iron must give way to copper, sooner or later, at practically all points in this field. Many local telephone systems are installed with iron wires, but so certainly as such installations become successful, the replacement of iron by copper wires is certain to begin. Iron wires for telegraph lines are in quite general use on branches, but the principal telegraphic trunk lines are of copper.

Metallic sodium has been tested for overheard transmission. Owing to the great affinity of sodium for oxygen, it is necessary that it be protected from the air by being run into wrought iron pipes, which in turn are protected by weather-proof paint. It is claimed that, for the same conductivity, the cost of building a sodium conductor is only about 40 to 60 per cent. that of a copper conductor, but these figures are viewed with suspicion, and while sodium may become a serious competitor of copper for power transmission, in time, the prospects of strong competition from this source do not seem alarming.

Copper has but one really formidable competitor, this being aluminum, and in view of the very considerable substitution of aluminum for

copper, in certain fields, and the threat of even more strenuous competition, serious inquiry into the subject seems warranted in a work devoted to copper.

The electrical conductivity of aluminum is 63, compared with 101 to 103 in the best grades of copper. As compared with copper, aluminum has fair electrical conductivity, but lacks tensile strength. The latter defect, however, is overcome to a large extent by the greater lightness of aluminum, its atomic weight being 27, as compared with 63.2 for copper. Aluminum does not oxidize readily in the atmosphere, but when brought into contact with iron an electroytic action is brought about that causes rapid deterioration. The use of aluminum transmission wires, where exposed to the action of salt water, is impracticable, owing to rapid corrosion, and for the same reason this metal cannot be used for sheathing vessels. Aluminum wires are claimed to be superior to copper for damp places, or for withstanding acid fumes and moisture in the air or soil, these having but slight effect on aluminum.

One of the principal defects encountered in the use of aluminum for transmission wires is found in the great difficulty experienced in making good joints, although it has been stated, repeatedly, that this trouble has been overcome. Owing to the difficulty with which joints are soldered or brazed, the connections are mainly in the form of a three-way sleeve, giving a straight joint equivalent to a straight splice. In the case of large wires, dove-tailing is adopted, and, in smaller wires, a flattened tube is used occasionally. The conductivity of aluminum transmission lines is impaired somewhat by slight oxidation at the joints.

Aluminum being much lighter than copper, the number of poles required for a transmission line can be reduced, but owing to the large coefficient of expansion, aluminum wires sag heavily in warm weather.

The principal electrical use of aluminum is found in power transmission lines. This metal having lower conductivity and considerably less tensile strength than copper, its use necessitates bars or wires of considerably larger section, which disadvantage is balanced by the much lighter weight, but wires of aluminum are much more apt than those of copper to suffer from the stresses of snow, ice and wind, because of lesser tensile strength. Aluminum cables are in use in a California transmission line that carries power for a distance of 154 miles, to San Francisco. The longest transmission line is from Niagara Falls to Syracuse, a distance of 162 miles. This latter installation includes nine aluminum cables, each containing nineteen wires, giving a total length of about 28,000 miles of wire, the cables carrying a voltage of 60,000. The general concensus of opinion among those who have used both aluminum and copper wires, for power transmission, is that aluminum is materially cheaper in first cost, but not so satisfactory in operation, being more subject to acidents, and requiring greater outlay for upkeep.

The use of aluminum in electric railway systems is limited practically to high-tension lines for feeder cables, as it cannot be used for trolley lines because aluminum will not solder or braze satisfactorily, and trolley wires require carefully soldered or brazed joints made smooth. If a satisfactory method of brazing or soldering aluminum can be invented, and this would seem probable to come in time, aluminum will become a competitor

of copper in the trolley field, on practically the same terms as the metals now compete in the field of long distance power transmission. For high-tension feeder wires on trolley lines aluminum possesses one marked advantage over copper, in that it does not melt when short-circuited, as copper does.

Although extensive tests have been made with aluminum wires for telegraph and telephone lines, these have not proven satisfactory, and the metal is but slightly used for these purposes, aluminum wires being found lacking in tensile strength. The telephone and telegraph companies prefer steel wire to aluminum, and copper wire to either.

The weight of aluminum rolled is 162 pounds to the cubic foot, and for copper, 555 pounds per cubic foot. In electrical capacity for power transmission, one pound of aluminum is nearly but not quite equivalent to two pounds of copper, hence in figuring a parity between the metals, for power transmision purposes, the base can be secured by doubling the market price of copper and comparing same with the market price for aluminum, but for the purpose of final comparison, allowances must be made for the cost of drawing the wires and further allowance made for the added expense and difficulty of securing satisfactory joints in the aluminum transmission lines.

Aluminum was given an excellent opportunity of demonstrating its capacity to replace copper, during the era of high prices of the latter metal that culminated in the market break of July, 1907, but it cannot be learned that there was any very general substitution of aluminum for copper, on account of the high price of the later metal, although advocates of the substitution of aluminum for copper claimed that with copper at 26 cents and aluminum at 39 cents there was an economy of 50 per cent. in price, and of 55 per cent. in weight, in favor of aluminum.

Aluminum is becoming a serious competitor of brass in the manufacture of light castings, but for heavier work does not seem to have made much headway as yet. The aluminum castings have superior lightness, but lack the tensile strength of brass. The principal use of aluminum castings has been made by the automobile trade, but such castings do not seem to have been entirely satisfactory to some manufacturers, although well liked by other makers. Aluminum seems to be a very satisfactory substitute for copper and brass in the making of pans, kettles and boilers for various industrial uses, such as sugar manufacturing, wax refining, fruit canning, etc., and for kitchen utensils is much preferable to copper or brass. For certain uses, such as buckles, buttons, canteens, cups and other equipments for troops, the extreme lightness of aluminum renders it preferable to brass or any other metal.

For some uses various alloys of aluminum possesses considerable advantages over the pure metal, but some of the much-touted alloys of aluminum have given results falling far short of the promises made for them. There are, however, several aluminum alloys of marked value. Alloyed with about 1.5 per cent. copper, aluminum wire gains materially in tensile strength and loses nothing in ductility, wire so alloyed permitting spans of 150 feet in length, for long distance transmission lines carrying high-voltage currents.

The present production of aluminum is only a trifle more than one

per cent. that of copper, and is about the same in tonnage as the copper production of a century ago. It is probable, however, that the production of aluminum will show a larger proportionate increase than that of copper, for the next decade.

As matters now stand, with aluminum around its present range of prices and production, it scarcely can be considered a serious competitor of copper in any single field, with the exception of long-distance power installations, but given a material decrease in the cost of production of aluminum, through improved processes which are possible, though not yet in sight, a largely increased production would be assured, as the supply of raw material is absolutely inexhaustible, and were the metal to be sold at a price corresponding to a considerably reduced cost of production, which might not be the case immediately, if the new processes were controlled by a monopoly, but would be certain to come in time, aluminum would become a competitor to be reckoned with seriously by all the other commercial metals, but the brunt of the fight would be borne by tin and copper, and probably tin would be the greater sufferer of the two, in the long run. Apparently the supremacy of copper in its leading fields is not severely threatened by aluminum, which metal will make a place for itself in the industrial world, having certain advantages that must greatly extend its present use, and certain limitations as well, which, in all probability, will operate to prevent its becoming a dangerous competitor of copper.

CHAPTER XIII.

Glossary of Mining Terms.

The following glossary of mining, milling and trade terms first appeared in Vol. II of the Copper Handbook, and has been amplified in 1903 and 1907. It will be found fairly complete.

ACICULAR. Needle-shaped.

ACID. An acid rock is one in which bases are combined with acids, forming salts. The antithesis of basic.

ADIT. A mine opening, driven from the surface into a hill or mountain, on practically a horizontal plane, only enough rise being allowed to provide for natural drainage and to allow the easy removal of cars bringing rock from the breast of the working. An adit can be driven only where the surface is mountainous or quite hilly.

ADOBE. Sun-dried brick.

AIR-BLAST. A violent explosion, caused by the escape of air compressed by the settling of the upper workings of a deep mine.

AIR-COMPRESSOR. A machine for condensing air to a pressure sufficient to actuate machinery, when delivered underground, or elsewhere, at a considerable distance.

AIR-DOORS. Owing to strong currents of air frequently found in the depths of mines, it is sometimes necessary to build a little chamber in a drift connecting two shafts, with a door at either end, to prevent extinguishment of the lamps and candles of the miners by strong air currents.

AIR-DRILL. A power drill operated by compressed air.

AIR-SHAFT. A shaft sunk solely to provide ventilation for deep workings, or an old shaft kept open solely to furnish air to the mine. Nature provides a means of ventilating even very deep mines. Two shafts, one of which is sunk on slightly higher ground than the other, will provide natural ventilation underground, when connected by a drift, the longer shaft becoming a chimney, and the shorter an inverted syphon, down which the air is sucked with great force.

ALKALI. An alkali is a lye—the opposite of an acid.

ALLOY. Two or more metals united mechanically, but not chemically, by fusion.

ALLUVIUM. Soil or broken rock deposited by the action of water.

ALTERED. An altered rock is one that has undergone changes in its chemical and mineralogical structure since its original deposition.

ALUMINOUS. A rock having aluminum as a base or prominent constituent element.

AMALGAM. A union of mercury with other metals, such as gold, silver or copper. Mercury will not amalgamate with iron.

AMALGAMATION. The process of uniting gold, silver or copper with mercury. The quicksilver is expelled later, by heat, and recovered for further use.

AMORPHOUS. Without structural form.

AMYGDALOID. A trap rock, of igneous origin and frequently of highly complex structure, the name coming from the little pits or amygdules of softer rock-material found therein. In the Lake Superior copper district the copper-bearing amygdaloids frequently show the native copper in the amygdules left by the leaching out of the softer rock originally contained therein.

AMYGDALOIDAL. Of the nature of or akin to amygdaloid.

ANALYSIS. A complete chemical test of any given substance.

ANHYDROUS. Devoid of water.

ANTICLINE. A fold of rock-strata bulging upwards, in saddle-shape. The reverse geologically of syncline.

ANTICLINAL. An anticline. Of the nature of an anticline.

ANTIGUA. In Mexico, is a mine worked by Spaniards or Mexicans at a time so remote—from 50 to 300 years—that particulars have been forgotten. Sometimes valuable.

APARTADO. Apartado de correos is Spanish for postoffice box. Usually written apartado only or abbreviated to Ap.

ANTIMONIDE. An ore of any metal chemically united with antimony.

APEX. That part of an ore vein at or nearest surface. In the United States usually requires opposing experts and several lawsuits to determine. In case of litigation, rightful title to the apex usually rests in the litigant having the most money.

APICE. Apex.

ARENACEOUS. Of a sandy nature.

ARGENTIFEROUS. Silver-bearing.

ARGILLACEOUS. Of a clayey nature.

ARASTRA. A Chilean mill. A circular trough, in which broken ore is pulverized by a revolving wheel or mill stone

ARROYA. A gulch.

ARROBA. A weight of varying heft. Spanish, 25.36 pounds avoirdupois; Portuguese, 32.38 pounds.

ARSENIDE. An ore of any metal, of which arsenic is the other constituent.

ARSENOPYRITE. An ore of any metal with which arsenic and sulphur are chemically united.

ASSAY. A chemical test of ore or metal to determine its exact content and value in any given metal or metals.

ASSESSMENT WORK. The amount of work required annually by the United States government, from the holders of an unpatented mining claim.

ATTLE. Cornish term for waste rock.

AURIFEROUS. Gold-bearing.

AUXILIARY. An auxiliary engine or machine is one kept in reserve for use when the principal machine is out of commission.

AVERAGE PRODUCE. Cornish term for percentage of copper in ore.

BACK. The roof of rock above any mine opening driven on a horizontal plane.

BAD AIR. Air in which miners cannot work, owing to powder fumes, noxious gases or insufficient ventilation.

BAL. Cornish for mine.

BALANCE BOB. A counterweight for pump rods.

BALL HEAD. A steam stamp, named after its inventor.

BALL STAMP. A Ball head.

BARRANCA. A deep gulch or cañon, with precipitous sides.

BARILLA DE COBRE. Spanish term for native copper, dressed but unsmelted. Equivalent to the "mineral" of Lake Superior mines. Used mainly in Bolivia.

BARREL WORK. Copper in small masses, detached from its rock-matrices at the rock-house, and shipped in barrels direct to the smelter.

BARROW. A wheelbarrow; also same as burrow.

BARTLETT. A Bartlett concentrating table.

BASALT. A trappean rock.

BASE. An alkaline element.

BASE BULLION. Copper or lead carrying much gold or silver.

BASE METAL. Any of the more common metals except gold, silver and platinum.

BASIC. Of an alkaline nature.

BASIN. A syncline; a trough in the earth's surface.

BATTERY. A set of gravity stamps, usually five in number.

BEARING. The bearing of a mineral outcrop is its strike.

BEATING AWAY. To cut down or stope a mineral body.

BED. A stratified rock formation. Used in some mineral districts for veins or lodes lying horizontally, or approximately so.

BEDDED VEIN. A vein parallel with the stratification of country rock.

BED ROCK. The solid rock, as differentiated from loose or surface rock. The ledge.

BELLS. Signals for lowering and hoisting the bucket, skip or cage in a shaft usually are given by bells, the number of strokes indicating the nature of the load, the place for stopping, etc.

BIT. A steel drill; a short hollow cylinder of soft steel, used in diamond drilling. The diamonds are set around the inner and outer edges of the bottom of the bit, boring the most refractory rocks when the bit is rotated.

BLACK COPPER. Copper partly smelted, but containing impurities requiring refining.

BLACK JACK. Sphalerite, zinc blende of dark color.

BLANCHED COPPER. Copper containing a large amount of arsenic, practically forming an alloy.

BLAST. (N.) Air forced through tuyeres into a blast furnace or bessemer converter. (V.) To explode gunpowder or dynamite.

BLASTED. A blasted miner is one who has been injured by the explosion of a charge of dynamite or gunpowder.

BLAST FURNACE. An oven in which ore is smelted, with the aid of air pumped in under pressure.

BLASTING. The breaking of rock by means of high explosives, inserted in holes bored in the rock for the purpose.

BLENDE. Zinc blende; sphalerite.

BLIND DRIFT. A drift connected with other workings of the mine at one end only. A cul de sac.

BLIND LODE. A lode not outcropping at surface.

BLISTER COPPER. Copper of 96 to 99 per cent. tenor.

BLOCKING OUT. Opening the ore in a mine so that it can be won merely by stoping. Properly speaking, ore is not blocked out for stoping until opened on three sides.

BLOSSOM. The outcrop of an ore body altered by weathering.

BLOW. A blossom.

BLOWER. A fan used to force air into a mine; a blowing engine.

BLOWING ENGINE. A rotary engine for forcing air into blast furnaces under an average pressure of about one pound avoirdupois per square inch.

BLOWING IN. A smelting furnace is blown in when charged and the process of reduction by fire is begun.

BLOWING OUT. A smelting furnace is blown out when the metal and slag are tapped out, and the fires are allowed to die out.

BLOWOUT. An outcrop larger than the ore-body beneath.

BLUESTONE. Copper sulphate.

BOILING SHAFT. A sand-shaft in which quicksand and water boil up from the bottom.

BONANZA. A body of exceptionally rich ore. Commonly applied to silver mines.

BONNET. The cover or roof of a cage; also a steel casting connecting the piston-rod with the upper end of a stamp-shaft.

BORE HOLE. A drill hole bored for test purposes.

BORT. A form of crystallized carbon between the diamond and the black diamond.

BORTZ. Bort.

BOTRYOIDAL. Shaped like a bunch of grapes.

BOTTOM. A mass of impure copper formed below the matte, in matting copper ores.

BOULDERS. Detached masses of rock, rounded by attrition, usually found at or near surface, in alluvial deposits lying above rocks in place.

BOX CAÑON. A cañon closed at one end.

BRANCH. A vein branching off from the main ore body.

BRATTICE. A screen for the regulation of air currents in a mine.

BREAST. The face or working end of a drift, stope or adit.

BRECCIA. A conglomerate rock, in which angular fragments of rock are cemented together.

BRECCIATED. A rock stratum made up of sharply broken fragments, partially or wholly cemented together.

BROKEN. A vein is broken when lacking clearly defined walls or characteristics of regularity.

BROKEN GROUND. Rock strata where the walls are poorly defined and the general formation unsettled.

BROOD. Cornish for waste ore, such as mundic or zinc blende, when found in connection with copper ores.

BUCKET. A kibble. An iron or steel bucket used for hoisting in a mine. In a vertical shaft a bucket swings free in ascending and descending, but in an incline shaft the bucket runs on a skidway of plank timbers, or ride a trolley cable.

BUDDLE. A conical table on which ore is dressed. Machine and name both growing obsolete.

BULKHEAD. A wooden or masonry partition walling off a mine opening, or protecting mine sets against soft or creeping ground.

BULLION. Refined gold or silver. Sometimes erroneously applied to copper.

BULLION BARS. Unrefined gold and silver secured by melting the precious metals precipitated to the bottom of the tank in the electrolytic refining of argentiferous and auriferous copper anodes.

BUNCH. A pocket of exceptionally rich ore.

BUNCHY. An ore body given to considerable variations in width or values, or both.

BURDEN. Overburden.

BURROW. A rock burrow.

CABLE. The steel wire rope used in shafts for hoisting buckets, skips or cages.

CAGE. The elevator used in vertical shafts for hoisting mineral and for lowering men, timber, etc.

CAKES. Copper cast in the form of cakes.

CALCAREOUS. Of a limey nature.

CALCINE. To drive off sulphur or other volatile constituents of an ore by heating.

CALCINER. A calcining furnace.

CALCINING FURNACE. A furnace for roasting ore to drive off sulphur, previous to smelting.

CALCITE. Crystals of calcium carbonate.

CAM. A curved tooth, fixed on a shaft, for lifting the pistons of gravity stamps.

CAMP. A mining town.

CAÑON. (pronounced canyon). A deep gorge with precipitous walls.

CANYON. A cañon.

CAP. The top piece of a framed set of mine timbers; copper caps containing fulminate of mercury, used to explode dynamite in blasting rock.

CAPPING. The rock or other ground overlying the mineral body of a mine.

CAP-ROCK. Capping.

CAPTAIN. In most mining fields where Cornishmen are found, the man in charge of mining work is termed a captain. The mining captain is the executive officer underground.

CARBONACEOUS. Of the nature of coal; containing carbon.

CARBONATE. An ore of any metal or metals with which carbon and oxygen are chemically united.

CARBONATES. A term commonly applied, in the western part of the United States, to ores containing a considerable proportion of lead carbonates, usually argentiferous.

CARBONIFEROUS. Rocks of the geological ages usually associated with coal measures.

CARGA. A Mexican weight equalling 300 pounds avoirdupois.

CARTRIDGE. Dynamite put up in cylindrical cases of oiled paper to fit the holes bored by drills.

CASING. The wooden lining of a shaft; an iron pipe put down outside of a diamond drill hole when passing through soft or broken ground, to prevent the hole becoming clogged by matter intruding from outside.

CASTING COPPER. Impure copper better suited for casting into various forms than for drawing into wires or rolling into sheets.

CAVE. A natural opening or "vug" in a rock formation; the partial or complete falling in of a mine.

CAVING SYSTEM. A plan of mining, by which the worked out upper levels and surface are allowed to subside gradually, as the mine workings are deepened.

CEMENT COPPER. Regulus. The impure metal obtained from ores by leaching processes.

CERRO. Spanish for a hill showing rock outcrops.

CHAMBER. A large stope.

CHAPEAU DE FER. French for gossan or iron hat.

CHARGE. The amount of ore, flux and fuel required for one filling of a furnace.

CHIMNEY. An ore body of pipe shape in an approximately vertical position.

CHERT. A coarse flint containing calcium.

CHILEAN MILL. An arastra.

CHILE BARS. Bars of Chilean blister copper, weighing about 200 pounds each.

CHLORIDE. The ore of any metal united chemically with chlorine.

CHLORIDES. Commonly applied, in the western part of the United States, to chloride ores of silver.

CHURN DRILL. A drill having a churning motion, used for boring test-holes, or wells.

CHUTE. A section of a lode or vein differing by being much richer or leaner than the average; also a trough for dropping ore or waste to lower openings in a mine.

CIRCA. Approximately.

CLACK. A pump valve.

CLAIM. Public land staked off and claimed by a prospector or miner. Size of claims varies in different countries.

CLAY COURSE. A seam of clay between vein and wall.

CLAY PARTING. A clay course.

CLAY SLATE. An argillaceous slate.

CLEAN-UP. The cleaning up of accumulated ore or metal in a mill or smelter.

CLEAVAGE. The parting of rock along more or less regular lines of least resistance.

CLEAVAGE PLANES. The lines along which rock cleavage occurs.

COARSE JIGS. The jigs used to handle the heavier grades of ore or metal.

COARSE METAL. Matte resulting from the first smelting.

COBBING. Breaking masses of ore into lumps by hand hammers.

COLLAR. The top of a shaft; the surface timbering of a shaft.

COMPANY ACCOUNT. Miners and other underground employes working on fixed wages per shift or month usually are called "company 'count men" to distinguish them from miners working on contract.

COMPARTMENT. Mining shafts usually are divided into two or more compartments, separated by framed timbers and planking.

CONCENTRATES. The concentrated ore or metal, after partial or complete elimination of gangue rock.

CONCENTRATION. The process of separating native metal or ore from its gangue of worthless rock.

CONCENTRATING TABLE. A concentrator.

CONCENTRATOR. A plant where ores are concentrated; a jig, or machine for separating ore or metal from gangue-rock, the process usually employing a rocking or oscillating motion, aided by jets of water, whereby

the worthless gangue is driven off and the heavier mineral retained by specific gravity.

CONCHOIDAL. A fracture resembling in form the shell of a bivalve mollusk.

CONCRETIONS. Nodules formed by aggregation of mineral matter.

CONDUCTIVITY. Electrical conductivity is measured by the resistance offered to the passage of an electrical current.

CONGLOMERATE. A rock stratum formed of pebbles and rounded boulders cemented together. Sedimentary conglomerates are ancient seabeds; volcanic conglomerates are called tuffs, and consist of scoriaceous matter ejected from volcanic vents and cemented to rock, under pressure.

CONSTRUCTION ACCOUNT. Many of the Lake Superior copper mines summarize their finances so that the cost of operation is divided into two classes, one being for general working expenses and the other for construction account. The latter includes new buildings and machinery on surface, and frequently new mine openings. In effect the construction account of a mine is like the stock account of a merchandise firm, and sometimes, like charity, "covers a multitude of sins."

CONTACT. The junction of two dissimilar bodies of rock.

CONTACT VEIN. A mineral body found between two unlike rock strata.

CONTORTION. The distortion of a rock body.

CONTOUR. The outline or configuration of any given tract.

CONTRACT. Many miners work on contract, agreeing to sink, drift or stope at a fixed price per running foot, or per fathom. These are known as contract miners, and are usually the more skilled workmen.

COPPER ORE. See detailed descriptions of copper ores and copper-bearing minerals in chapter on chemistry and mineralogy.

CORE. A drill core.

CORNISH PUMP. A form of mine pump actuated by long rods reaching from surface down the shafts.

CORNISH STAMP. A gravity stamp, in which the heads are raised by cams and dropped by gravity.

COST-BOOK SYSTEM. A plan of mine operation, used in Cornwall only, by which shares are subject to unlimited assessment. A sort of unlimited partnership.

COSTEANING. Proving an ore body by trenching across its outcrop at approximately right angles.

COUNTERBALANCE. Hoisting plants usually are worked in counterbalance for deep shafts. The weight of the descending cage or skip is used to partially offset the weight of the ascending cage or skip.

COUNTER VEIN. A cross vein, running at approximately right angles to the main ore body.

COUNTRY ROCK. The predominant rock form of a given district.

COURSE. The direction or strike of a mineral body; a stretch of mineralized matter in an ore vein.

CRAB. A hand winch.

CREEPING. The movement caused in mines by the pressure of superincumbent and adjacent rock masses.

CRETACEOUS. Of a chalky nature; limestone of a certain geographical horizon.

CRIBBING. The lining of a shaft; frameworks of timber to support an underground roof.

CROPPINGS. Outcrops.

CROSS COURSE. An intersecting vein.

CROSSCUT. An opening similar to a drift, except that the crosscut is sent at approximately right angles to the formation, while a drift follows the trend of the lode or vein.

CROSSCUT TUNNEL. A tunnel driven at approximately right angles to the ore body.

CROSS VEIN. An intersecting vein.

CRUCIBLE. A vessel of refractory material, used to contain ores and metals for assaying or smelting.

CRUSHER. A rock crusher.

CRYSTALLINE. Showing crystals.

CRYSTALLIZED. Having plainly defined crystals.

CRYSTALS. Geometrical forms, with plane faces, of infinite variety, assumed by the majority of minerals.

CUPOLA. A furnace in a smelter.

CUPRIFEROUS. Copper-bearing.

CUT. To intersect an ore body; the portion of a working face of mineral removed at one operation.

CUTTING DOWN. To enlarge a shaft.

CWT. A hundredweight, or 112 pounds avoirdupois.

DAM. A masonry barrier, built underground, to hold back water.

DATUM LEVEL. The level (usually sea-level or mean level of nearest considerable body of water) from which altitudes are measured in surveys.

DEAD ROASTING. Sulphide ores are dead roasted when all the sulphur possible to drive off by roasting has been eliminated.

DEAD WORK. The opening of new shafts, drifts and winzes, preliminary to the stoping of the mineral bodies.

DEBRIS. Broken down rock material.

DECOMPOSED. Rock or ore broken down by elemental action.

DECREPITATE. To break into fragments with violence, under the blowpipe or great heat.

DENDRITE. A mineral crystallized in form similar to the branch of a tree.

DENOUNCEMENT. In Mexico, the formal filing of a claim to mineral land.

DENUDATION. The uncovering of rock strata by the weathering of wind or water, or both.

DEPOSIT. A term, loosely used, meaning a mineral body.

DERRICK. A mast, freely rotatable, carrying a boom or yard-arm, at the end of which is a sheave-wheel. In mining is used mainly for open pit work.

DESSICATION. The drying out of water from any given substance.

DETRITUS. Debris. Broken down rock.

DEVELOPMENT WORK. Dead work.

DIAMOND DRILL. A machine for boring holes in rocks, taking its name from the black diamonds or bort used to form cutting surfaces on the inner and outer edges of the hollow cylindrical bit.

DIE. The iron block in the mortar, onto which the ore is fed for crushing under the stamp.

DIORITE. Greenstone; a crystalline spathic hornblende.

DIP. The angle at which a lode or vein descends from the earth's surface.

DIP COMPASS. A compass having the needle fixed to swing in a vertical plane.

DIRT. Frequently used to designate ore broken underground.

DISINTEGRATION. The breaking down of rock forms, usually through weathering.

DISSEMINATED ORE. Ore found scattered through a gangue of valueless rock.

DISTURBED. An ore body is disturbed when lacking defined walls and settled character.

DOLLY. A crude prospecting stamp set on a spring pole.

DOLOMITE. Magnesian limestone; carbonate of calcium and magnesium.

DONKEY HOIST. A small auxiliary hoisting engine, usually operated underground and actuated by compressed air, or used for preliminary work at new shafts or exploring pits.

DOWNCAST. A shaft having a downward air current.

DRAFTAGE. An arbitrary allowance claimed by some British smelters, to cover loss of weight in transport.

DRESS. To separate ore from gangue rock by hand or machinery.

DRESSING FLOOR. A floor or dirt surface where ore is dressed by cobbing and other hand-work.

DRIFT. A horizontal opening in a mine, following the direction of the lode or vein; loose alluvial matter, such as sand, pebbles and boulders.

DRIFT COPPER. Native copper found in alluvium, far from its original rock matrice, whence carried by glaciers.

DRIFTING. Opening drifts. Driving.

DRILL. A steel bar for boring in rock, having a single sharp cutting face, or two cutting faces crossed at right angles.

DRILL-CORE. Solid, cylindrical cores of rock, are cut by the operation of the diamond drill. These are raised to surface and form a valuable permanent record of the strata through which the drill has passed.

DRILL HOLE. A hole bored by a drill.

DRIVE. A drift.

DRIVING. Drifting.

DROP SHAFT. A shaft, usually of heavy framing sunk by weight, through sand or similar material.

DRUM. The cylinder of a hoisting engine, around which the cable winds.

DRUSE. A vug.

DRY ORE. Argentiferous lead ores containing insufficient lead for fluxing in a smelter.

DUCTILE. That which is capable of being extended in length by tension.

DUCTILITY. The capacity of a metal to elongate, when under pull from the ends, without cracking or breaking.

DUMP. A place for depositing rock taken from a mine. An ore-dump contains good mineral, and a waste-dump the worthless rock hoisted from underground.

DYKE. A fissure in the rock formation, usually transverse, filled with igneous matter. When mineralized, dykes are called cross or counter veins.

DYNAMITE. Nitro-glycerine absorbed by wood pulp, infusorial earth, or some similar article, to render it safer in use. Power varies greatly according to percentage of nitro-glycerine contained.

EISENER HUT. German for iron hat, or gossan.

EECTRIC DRILL. A power drill operated by an electric current.

ELECTROLYTE. The solution in which electrolytic separation of metals is carried on.

ELECTROLYSIS. The separation and redeposition of metals by electrolytic action.

ELECTROLYTIC. Term applied to copper means copper gained from impure metal by electrical decomposition and redeposition, whereby the copper is taken from an impure bar and redeposited in a pure form at the opposite pole of the battery, while other metals are precipitated to the bottom of the solution in the tank in which the work is done.

ELVAN. Cornish name for the dyke rocks of Cornwall, usually greenstone or porphyrite.

EROSION. The wearing away of surface masses of rock and soil by the elements, or by glacial action.

ERUPTIVE. Rock matter deposited in molten form by volcanic action.

ESCARPMENT. A rock wall, nearly or quite vertical.

EXFOLIATION. The separation of thin leaf-like layers from the main body.

EXPLODERS. Fulminating caps, for setting off high explosives.

EXPLOITATION. Development work and production.

EXPLORATION. Prospecting work.

FACE. The breast of a drift. A face of ore is the ore shown at the working end of a drift or stope.

FAHLBAND. A banded crystalline rock, carrying finely disseminated ores.

FALL OF GROUND. Rock falling from the roof into a mine opening.

FALSE SET. A temporary set of timber.

FAN. A machine for forcing air into a mine.

FATHOM. Six feet. In stoping, a fathom is a cube of six feet.

FAULT. Dislocation of a rock stratum by which continuity is lost.

FEE. The ownership of land in fee-simple.

FEE-OWNER. The owner of land in fee-simple.

FEEDER. A branch ore vein.

FERRUGINOUS. Carrying iron.

FILLING. Occupying old stopes or chambers with waste rock; allowing a mine to fill with water.

FINES. The finer ore or metals saved in concentrating processes.

FINISHER JIGS. The jigs used to save the fine ores or metals in a concentrator or stampmill.

FIRE. The miner's warning cry when a blast is to be set off, is "fire."

FISSLE. That which easily may be split.

FISSURE. Rock matter deposited at a later period, in a crack in the original rock.

FISSURE VEIN. A fissure, containing ore, usually disseminated in a worthless gangue.

FLAKE COPPER. Very fine scales of native copper.

FLEET-GEAR. A compensating device for taking up slack and paying out rope where a hoisting system is worked in counterbalance. Several turns of the cable are taken around each drum of the hoist, and the bight of the cable is carried to the rear and around a large sheave-wheel lying horizontally and traveling on trunnions, allowing the taking up or paying out of the cable.

FLOAT. A particle or boulder of ore or rock, dissociated from its matrix.

FLOAT COPPER. Drift copper.

FLOAT ORE. A detached ore mass found at a distance from its matrice.

FLOOR. The floor of a drift or other horizontal mine opening; the underlying rock stratum.

FLOUR COPPER. Very fine native copper that floats on water and is very difficult to save in milling.

FLUCCAN. A seam of clay, found in ore bodies, or more frequently, between the ore and walls of country rock.

FLUKAN. Fluccan.

FLUME. A launder or pipe line for carrying water.

FLUX. Any mineral used in the furnace to aid in fusing the gangue rock and worthless elements, which combine with the flux to form slag.

FLUXING ORE. An ore containing appreciable metallic values, but smelted mainly because containing fluxing agents required in the reduction of richer ores.

FOLIATED. Having a laminated structure.

FOOT. The foot-wall.

FOOT-WALL. The stratum of rock underlying an inclined mineral lode or vein.

FORK. To pump water from a mine; the branching of a vein.

FORMATION. A term used to imply the general geological conditions of a given district.

FOSSICKING. Extracting ore from old mines or waste-burrows.

FOUNDERS SHARES. The few shares necessarily issued to individuals organizing a stock company. In case of companies owned outright by other companies, founders shares are issued to as many individuals as are required to incorporate and hold the offices required for corporate management, as the laws do not permit a corporation, which is an artificial person, to form another corporation, or to serve as a director of another corporation.

FRACTURE. A break.

FREE. A metal is free when virgin or native, and not combined chemically with any other element.

FREE MILLING. A metal or ore that is separated readily from its accompanying rock by mechanical means.

FREEZE. A furnace freezes when the heat falls sufficiently to permit the molten charges to solidify.

FRIABLE. That which may be pulverized easily.

FROZEN. A furnace is frozen when its molten charge solidifies.

FURNACE. An oven for the smelting of ore.

FUSE. A cotton cord with a gunpowder core, so made as to carry fire to an explosive placed for use.

FUSIBLE. That which may be melted.

FUSION. Melting. Alloying metals while liquid, through heat.

GRABBRO. A rock composed mainly of plagioclase feldspar.

GAD. A small wedge or chisel.

GALENA. Lead sulphide, frequently found associated with sulphide copper ores.

GALLERY. A drift.

GALLOWS FRAME. A framework over the mouth of a shaft, carrying a sheave-wheel, over which the hoisting rope passes to the engine.

GANGUE. The foreign rock matter in which ore or metal is disseminated, the gangue rock being mechanically and not chemically united with the ore or metal.

GASH VEIN. A shallow fissure vein, rapidly narrowing to extinction.

GEODE. A hollow nodule of rock.

GEOLOGICAL HORIZON. Geological age.

GEOLOGY. The science of the formation of the earth.

GIANT POWDER. Dynamite.

GLACIATION. The erosive effect produced by glaciers.

GLANCE. Any metallic sulphide showing a bright, shining surface. Copper glance is chalcocite.

GLORY HOLE. A large open pit from which pay ore is or has been extracted.

G. M. B. "Good Merchantable Brands"—an English grade of refined copper. Term becoming obsolete.

GNEISS. A banded, slaty granite.

GOB. Mud above a mine; refuse in worked-out openings.

GOPHERING. Prospecting work confined to digging shallow pits or starting adits. Term used from similarity of this work to the crooked little holes dug in the soil by gophers.

GOSSAN. Iron hat. A rock capping, usually quartzose, showing yellow to reddish brown iron stains, from disseminated limonite or hematite. Frequently is found overlying veins of copper ore.

GRADE. The percentage, or value, of ore bodies and partly refined metals; the percentage of rise in roads or mine openings driven on an approximately horizontal plane.

GRANITE. A dense, granular rock, composed of varying proportions of quartz, feldspar and mica.

GRANULATED. In the form of grains.

GRASS ROOTS. At surface.

GRAVITY STAMP. A stamp, usually set in batteries of five, in which the piston is raised by a cam, the stamp crushing the charge in the mortar by its weight, when allowed to fall.

GREENSTONE. Diorite, or gabbro.

GRIZZLY. A grating of heavy iron or steel bars, through which fall the smaller pieces of rock or ore.

GROSS TON. A long ton of 2,240 pounds avoirdupois.

GROUNDSILL. The bed-piece of a set of mine timbers.

GUIDES. Perpendicular wooden stringers for guiding cages in vertical shafts.

GUT. To rob.

HACIENDA DE BENEFICIO. Spanish for milling plant.

HACIENDA DE FUNDICION. Spanish for smelter.

HADE. (American). Dip of a vein from the zenith. (English). Dip of a vein from the horizon.

HALVAN. Cornish for refuse copper ore.

HANGING. The hanging-wall; the stratum of rock overlying an inclined mineral lode or vein.

HARDHEAD. A lump of partly smelted ore, carrying high percentages of refractory elements, such as iron, antimony and arsenic.

HAT. The capping of a mineral body.

HAULAGE PLANT. A mechanical installation for the underground tramming of rock, operated by ropes, compressed air or electricity.

HEAD. Water pressure.

HEADGEAR. A building, or framework, fitted with sheaves, over the mouth of a shaft.

HEAP-ROASTING. Burning the sulphur out of ores piled in heaps, with a small amount of wood or other fuel.

HEAVE. A fault. The rolling out of line of dip by a lode in making depth.

HEAVING. Rolling.

HECTARE. A metric measure of area equalling 2.471 acres.

HECTAREA. Spanish for hectare.

HOIST. An engine for raising ore from a mine, and for lowering men and material thereinto.

HOISTER. A hoist.

HOLE. Any opening in the ground; a hole drilled for explosives.

HOLING THROUGH. A drift or other mine opening is holed through when a connection is made between two separate sections working toward each other.

HORIZON. The sky-line, commonly used in the sense of absolutely flat, as shown by a spirit level. Geologically, all rock strata of the same geological period.

HORSE. An intrusion of country rock into a mineral body; sometimes used as synonymous with dyke.

HORSEPOWER. One horsepower is rated as equivalent to raising 33,000 pounds avoirdupois, to a height of one foot in one minute.

HORSE-WHIM. A windlass operated by horse-power.

HOT BLAST. Heated air supplied to a blast furnace.

HUEL. Wheal.

HUNGRY. Nearly or quite barren of mineral value.

HUNTINGTON MILL. An improved Chilean mill.

HYDRATED. Containing water of crystallization.

HYDRO-METALLURGY. The reduction of ores by wet processes.

HYDROUS. Containing water of crystallization.

IGNEOUS. Of volcanic origin.

IMPREGNATED. Containing ore. Properly used in referring to country rock carrying mineral similar to that in the vein.

INCH. One-twelfth of a foot. See Miner's inch.

INCLINATION. The dip of a vein from the horizon, measured in degrees.

INCLINE SHAFT. A shaft sunk at any except a vertical angle with the horizon.

INCRUSTATION. A solidified coating, usually crystallized.

INFILTRATION. The deposition of a mineral matter from percolating waters.

INGOT. A mass of metal cast in a peculiarly formed mold; applied only to gold, silver or copper. Iron and lead are cast in pigs.

IN PLACE. Rock matter in the position where deposited by nature.

IN SITU. In place.

INTAKE. The opening for water to enter a pipe or flume.

INTRUSIVE. Igneous rock masses pushed up through other and older rock formations.

IRIDESCENT. Showing the colors of the rainbow.

IRON HAT. Gossan.

JACK. A miner's name for sphalerite. Is called black jack, ruby jack or rosin jack, according to color.

JIG. A machine for concentrating ore or mineral by means of oscillatory or vibratory motion, aided by jets of water, separation of the ore from its gangue being effected by utilizing the greater specific gravity of the former.

JIGGER. A crude jig.

JIGGING. Concentrating ore by the use of a jig.

JUMP. To take possession of mineral lands held or claimed by another party.

JUMPER. A churn drill; one who jumps a mineral claim.

JUNCTION. The uniting point; the point of contact between dissimilar rock forms.

KEWEENAWAN. Pertaining to or of the Keweenaw formation, in which the Lake Superior copper mines are opened.

KIBBLE. A bucket used for hoisting material in a shaft.

KILLAS. Clay slate or shale.

KILO. A kilogram.

KILOGRAM. A metric weight of 2.2046 pounds.

KILOMETER. A measure of distance equalling 0.621376 miles. For rough computations may be figured as five-eighths of a mile.

KIN. A Japanese weight of 1.31 pounds avoirdupois.

KINDLY. The appearance of rock carrying or promising to carry good mineral values.

LADDER ROAD. A ladderway.

LADDERWAY. The series of ladders giving ingress and egress to a mine shaft; the compartment in which the ladders are.

LAGGING. Timber, usually of small diameter, placed over the cap-timbers of incline shafts and drifts, to prevent damage from falling rock.

LAMINA. A thin plate. Plural is laminae.

LAMELLAR. In thin sheets of laminae.

LAMINATED. Lamellar.

LANDER. The man at the mouth of the shaft, who receives signals from below, and attends to the unloading of rock sent up in buckets, skips or cages.

LAUNDER. A wooden flume or sluice, used to convey water, or tailings held in solution in water.

LAVA. Rock formed of flows from volcanoes.

LEACH. To dissolve minerals from ore by water, or acid, or both.

LEACHING. Lixiviation.

LEAD. A mineral body; the metal.

LEADER. A small vein running to a larger one.

LEDGE. The solid rock where encountered at or nearest surface.

LEG. An upright timber supporting the cap of a set of timber.

LEG-PIECE. A leg.

LENSE. An ore body of lenticular form.

LENTICULAR. Having the shape of a double convex lense.

LEVEL. A horizontal opening in a mine. Levels commonly are opened at stated intervals as depth is gained—usually at 100 feet in modern mining practice. The word "level" frequently is used interchangeably with the word drift, but is more comprehensive. Both drifts and crosscuts may be opened on a level, but a crosscut is not a level.

LIGNEOUS. Of a woody nature.

LIMESTONE. Calcium carbonate.

LIXIVIATION. The process of leaching out mineral values from ores.

LOCATE. To make formal claim to public mineral lands.

LOCATION WORK. Labor required by law to be done on mining claims when located.

LODE. Variously used in different mining fields. In Lake Superior refers to the mineralized stratified beds. Is used locally, in many fields, as synomymous with vein. Sometimes is used as meaning an aggregation of mineralized veins.

LONG TON. A gross ton of 2,240 pounds avoirdupois.

LOW GRADE. Carrying mineral values but sparingly.

MAGMA. An originally molten mass of rock coming to the earth's crust from depth.

MAGMATIC. Of the nature of or pertaining to magma.

MAGMATIC SEGREGATION. The process by which the different constituents of molten rock masses crystallize at varying temperatures,

NICKELIFEROUS. Carrying nickel.

NODULE. A small mineral mass of approximately spherical form.

NON-CONFORMABLE. Rock strata not associated originally in the position now occupied.

NUGGET. A lump of native metal. Term usually applied to gold.

OPEN-CAST. A mine worked as a quarry, without underground openings.

OPEN CUT. Open cast.

ORE. A chemical union of one or more metallic elements with other elements, usually non-metallic, of which oxygen, carbon and sulphur are the most frequent. For the various ores of copper, see chapter on chemistry and mineralogy.

ORE CAR. A mine car for carrying ore or waste rock.

ORE CHUTE. A specific portion of an ore vein carrying increased values. Usually has a vertical or diagonal dip on the plane of the dip of the ore body.

ORE DUMP. A dump for ore.

ORE SHOOT. An ore chute.

ORTHOCLOSE. Silicate of potassium and aluminum. An acid feldspar.

OUTCROP. The ledge of a lode or vein that is exposed on the surface of the earth.

OUTLIER. An isolated rock or group of rocks lying at a distance from the main body, and separated therefrom, on the surface of the earth, by a different rock formation.

OUTPUT. Production.

OVERBURDEN. Superincumbent material, usually drift or alluvium.

OVERHAND STOPING. Removing ore in ascending steps.

OXIDATION. Process of conversion of other minerals into oxides by weathering, or by the chemical effects of underground waters.

OXIDE. An ore of any metal or metals chemically united with oxygen.

OXIDIZE. To unite with oxygen. Many minerals and most metals oxidize with greater or less rapidity when exposed to air or water.

PARE. Cornish for a gang or shift of miners.

PARTING. The separation of two or more metals mechanically admixed by electrolysis, cupellation, use of acids or other chemical or metallurgical processes; a fluccan.

PASS. A winze.

PATENT. Direct title, from the government, to mineral lands.

PATIO. A walled yard with paved floor where finely crushed argentiferous ore is amalgamated.

PAYSTREAK. A portion of a vein or mineralized bed carrying workable values, occurring on either wall, or, occasionally, in the center of the mineral body.

PENTHOUSE. A shed-roof erected in the bottom of a shaft, when sinking, to protect miners from accidental fall of rock, timber or tools from above.

PENTICE. An erroneous spelling of penthouse.

PEROXIDE. The oxide of any metal containing the greatest proportion of oxygen.

PERPENDICULAR SHAFT. A shaft sunk vertically.

PERTENENCIA. One mineral claim in Mexico; area, one hectare, or 2.471 acres.

PETERING. Pinching.

PETER OUT. To pinch out.

PETROLOGY. The science of rocks.

PHOSPHATE. An ore of any metal or metals with which phosphorous and oxygen are chemically united.

PICK. A pick axe.

PICUL. A Chinese weight of 133 1-3 pounds.

PILLAR. A section of rock or ore left in place to support shafts or roofs.

PINCHING. The narrowing of a vein.

PINCHING OUT. The narrowing of a vein to extinction.

PIPE VEIN. An ore body of chimney form, deposited in the vent of an extinct volcano.

PIT. An opening in the earth's surface, usually shallow.

PITCH. Synomymous with "dip," but occasionally used to designate the angle of decline from the horizon, measured along the strike of the lode or vein.

PLAIN. A flat, champaign country.

PLANE. A level surface bounded by straight lines.

PLANT. The machinery equipment of a mine or reduction works. In general use the term includes buildings housing machinery.

PLAT. The enlargement of a shaft at a level, to give extra space for loading and unloading the cage, skip or bucket.

PLATEAU. An elevated plain.

PLUMBIFEROUS. Carrying lead.

PLUTONIAN. Plutonic.

PLUTONIC. Rock strata of volcanic origin.

POCKET. Underground, an ore deposit, usually of small extent. On surface, a bin at shaft-house or mill, in which ore, flux or fuel is stored.

POCKETY. Carrying only occasional bunches of good ore.

POLING. The process of adding carbon to a charge of molten copper in a reverberatory furnace by stirring with long poles.

POLL-PICK. A tool having a pick on one end, and a poll, or hammer head, on the other.

POOD. A Russian weight of 36.112 pounds avoirdupois.

POPPET-HEAD. Framework over a shaft for a sheave-wheel.

PORPHYRITIC. Of the nature of porphyry.

PORPHYRY. Like charity, covers a multitude of sins, and quite commonly is used to describe any crystalline rock. Properly, is any crystalline rock showing larger crystals upon a ground-mass of smaller crystals. Porphyry may be granite, quartz or one of several other rocks.

POUND. The troy pound is used for gold, silver and platinum only, the avoirdupois pound being used in weighing the other metals and other commodities in English-speaking countries.

POWER-DRILL. A machine for drilling holes in rock, actuated by compressed air, steam or electricity.

PRILL. Cornish for selected ore secured by cobbing.

PRIMARY. The first; the oldest rock formations.

PROP. A heavy timber placed with its foot against the floor of a mine opening, and its top against the roof, to support the rock above.

PROSPECT. To seek for mineral; a new mining property that has not yet earned the right to be called a mine.

PROSPECTOR. A searcher for mineral.

PROTOXIDE. The oxide of any metal containing the least proportion of oxygen.

PUDDINGSTONE. A coarse conglomerate showing rounded pebbles.

PULLEY-STAND. A temporary tripod or other light frame construction, holding a pulley, over which passes the rope used in hoisting.

PULP. Pulverized ore or concentrates.

PULVERIZE. To crush to powder.

PULVERULENT. That which easily may be reduced to powder.

PYRRHOTITE. Magnetic iron sulphide.

PYRITE. Iron disulphide.

PYRITES. Sulphide ores; more properly iron disulphide.

PYROGNOSTICS. Characteristics of a mineral under the blowpipe.

QUARRY. An open pit, of varying size, sometimes several acres, from which stone or ore is mined.

QUARTER-SECTION. In the United States a quarter of a square mile; 160 acres, laid out in a parallelogram, each side of which is one-half mile in length.

QUARTZ. Silica. Dioxide of silicon, frequently containing traces of iron and other minerals, and often the gangue of gold and other metals.

QUARTZ CLAIM. In the United States mining claims are divided into two classes, the first being placer claims, carrying mineral, usually gold, in alluvium, and quartz claims, this name being applied to any prospect carrying metalliferous bodies in place.

QUARTZITE. An oxide of silicon, with other minerals in varying quantities, partly granular and partly crystalline in structure.

QUARTZOSE. Rock having much quartz in its composition.

QUICKSAND. Fine sand, which flows easily when wet.

RAGGING. Cornish for rough cobbing; broken lumps of ore of medium size.

RAISE. A shaft or winze that is being opened from below. Sometimes called upraise or uprise.

RAKE VEIN. A vein cutting through stratified rocks.

RANGE. A mineral belt, also in many American states a surveyor's term for describing and locating lands. The state is surveyed in sections (with their subdivisions), towns and ranges. A town (or township) comprises 36 sections and is a square of six miles. Each township receives a double number, one for the town and one for the range. The towns are numbered consecutively from south to north, and the ranges are similarly numbered from east to west.

RAW ORE. Ore before treatment.

REAMER. A tool like a bit, used to enlarge a hole previously drilled.

REDUCTION. The separation of metals from their ores.

REEF. A stratified mineral-bearing rock formation.

REFINING. The elimination of impurities from crude metals, or separation of metallic alloys obtained in the reduction of ores.

REFRACTORY. A refractory ore is one that cannot be smelted by ordinary metallurgical processes. A refractory stamp-rock is one that is pulverized with unusual difficulty.

REGULUS. Copper matte.

RENIFORM. Kidney-shaped.

RESERVES. Bodies of mineral-bearing ground opened in a mine ahead of immediate requirements.

REVERBERATORY FURNACE. A smelting furnace in which the flame from the grate below is reflected back by the roof, on the charge of ore above.

RISE. A raise.

ROASTING. Driving off sulphur and other volatile elements from ore, by heat. When done in a furnace, under great heat, the process is called calcining.

ROASTING FURNACE. An oven for the expulsion from ore of sulphur, arsenic and other volatile elements.

ROB. To remove pillars and other supports from a mine for their mineral values, regardless of the future of the property.

ROCK. Stone.

ROCK BREAKER. A rock crusher.

ROCK BURROW. A pile of refuse rock from a mine.

ROCK CAR. An ore car.

ROCK CRUSHER. A machine for reducing rock or ore to smaller sizes. Crushers are of two types, the jaw-crusher and the centrifugal. The jaw crusher works as a man cracks nuts with his teeth, the centrifugal operates on the plan of a coffee-grinder.

ROCK DRILL. A power drill.

ROCK DUMP. A rock burrow.

ROCK FILLING. Waste rock, placed in worked-out stopes to support the roof.

ROCK-HOUSE. A building where copper-bearing rock is received and put through crushers before shipment to the mill. Is really a preliminary mill, and usually is built in connection with the shafthouse.

ROLL. To make depth at irregular angles.

ROLLS. Heavy steel rollers, worked in pairs, like a clothes wringer, for crushing rock and ore.

ROOF. The rock above a mine opening.

ROOM. Similar to a stope; term usually applied to mines working mineral bodies lying nearly horizontally.

ROYALTY. A percentage paid to the fee-owner from mineral values obtained by the lessee of a mine.

RULE-OF-THUMB. The guesswork and rough measurement plan of mining, in contradistinction to systematic development from data obtained by careful surveys.

RUN. A bar or course of ground better or worse than the average value of the mine.

RUNNING GROUND. Superincumbent material that falls into the mine openings.

SADDLE. An anticline.

SAFETY CAGE. A cage furnished with automatic appliances to stop its descent in case the cable breaks.

SALT. A chemical union of an acid with a base.

SALTING. Placing foreign ore in a mine to deceive intending purchasers or other interested parties.

SAMPLE. A specimen of ore from a mineral deposit. A selected sample usually is misleading because containing far above average values, and fine samples frequently come from the poorest mines. An average sample is what its name purports—if it be an average sample.

SAMPLING. Securing sufficient ore from mine openings to allow a test to determine average values. Honest sampling requires great skill and prolonged practical experience.

SAND PUMP. A pump, usually centrifugal, designed to lift water carrying large quantities of coarse tailings or sand in solution.

SANDS. Tailings from the stampmills of Lake Superior copper mines.

SAND SHAFT. A shaft sunk through quicksand.

SAND WHEEL. A large wheel, having buckets on its inner perimeter, for elevating water carrying stamp-sand.

SCALE COPPER. Copper in very thin flakes.

SCHIST. A metamorphic laminated rock of foliated structure, made up of superimposed flattened particles.

SCHISTOSE. Of the nature of schist.

SCORIA. Slags from copper smelters; volcanic ash.

SCORIACEOUS. Of the nature of scoria.

SCRAM. A mine that is being gone through carefully, when apparently worked out, for mineral previously overlooked.

SCRAMMING. Searching a mine for mineral previously overlooked.

SCREEN. A grating of perforated metal or woven wire.

SEAM. A thin layer of rock or ore.

SECONDARY ENRICHMENT. Nature's process of evolving high-grade from low-grade ores. See chapter on geology.

SECTILE. That which may be cut easily.

SECTION. A field or district; also, in the United States of America, a square mile of land.

SECTION POST. A boundary mark set at section corners, by surveyors.

SEDIMENTARY. Rocks formed by deposition from water, as contradistinguished from rocks formed by igneous action.

SELVEGE. Fluecan.

SET. A framed form of timber, used for supporting ground in a mine.

SHAFT. A downward mine opening having its upper end at surface.

SHAFT-HOUSE. A building at the mouth of a shaft, where ore or rock is received from the mine.

SHALE. An argillaceous slate, of fissile structure.

SHEAVE. A grooved wheel, notched to carry rope; an open pulley.

SHIFT. A miner's turn, of eight to ten hours' work; a force of men employed on one turn.

SHIFT-BOSS. A mine boss, or under-captain, in charge of one gang or party of miners.

SHOE. A stamp shoe.

SHOOT. A chute.

SHORT TON. A weight of 2,000 pounds avoirdupois.

SHOT. A blast of some explosive.

SHOT COPPER. Small rounded nodules of native copper, somewhat resembling small shot in size and shape.

SHUTE. A chute.

SILICA. Dioxide of silicon.

SILICATE. An ore of any metal or metals chemically united with silica.

SILICIOUS. Containing much silica or quartz.

SILL. The floor-piece of a set of mine timbers.

SINKING. The process of deepening a shaft or winze.

SINKING-PUMP. A movable pump, usually vertical, secured to a platform, and lowered as required, as the shafts are deepened.

SKIP. An iron box, open at the top, running on four wheels, and hauled

by a cable, used in incline shafts for hoisting ore and rock, and for lowering timber.

SKIP-ROAD. A track of T-rails, spiked to wooden sleepers, on which a skip runs.

SKIP-WAY. A skip-road.

SLAG. The vitreous refuse matter from a smelting furnace.

SLICE. To remove mine pillars.

SLICKENSIDE. A polished rock surface, showing striations produced by movement of adjoining rocks under great pressure.

SLIDE. A dissociation of strata caused by the subsidence of the overlying rock formation.

SLIME. Exceedingly small particles of rock and mineral held in solution in water.

SLIME TABLE. A circular revolving table, whereon slimes are worked, and the minute particles of mineral saved.

SLIP. A fault where a superincumbent stratum has slid downward.

SLUDGE. Mixed rock and water, brought to surface where a diamond drill cuts through very soft rock: tailings from a concentrator or mill.

SLUICE. A wooden flume or launder.

SMELTER. Works where ores or crude metals are freed from gangue or chemically united elements by heat.

SMELTING. The reduction of ores and crude metals, in furnaces, by heat, fuel and fluxing material being added to the matter to be smelted.

SMELTS. A smelter.

SOAPSTONE. Steatite.

SOFT GROUND. Underground openings that do not stand well and require heavy timbering.

SOLLAR. A platform in a shaft.

SPATHIC. Having a form approximating that of feldspar.

SPECIMEN. A sample of mineral selected because typical, unusual or exceptionally rich.

SPEISS. Impure metallic arsenides produced in copper smelting; ore particles finely disseminated throughout a rock, usually occuring as impregnations.

SPHALERITE. Zinc blende; zinc sulphide, often found associated with galena and chalcopyrite.

SPILL. Lagging driven ahead of the regular timbering in treacherous ground.

SPITZKASTEN. Pyramidal boxes wherein ores are concentrated and sized by a jet of water fed from below.

SPOON. A long-handled spoon, used to scrape out drill holes.

SQUARE SETS. A form of mine timbering having forms with mortised and tenoned sill, top piece and uprights of equal length, joined at right angles.

SQUIB. A fuse.

SPRAG. A cross-timber set to secure the hanging wall in a stope.

SPUR. A short branch from a principal ore vein.

STACK. The chimney of a furnace; usually employed to designate a number of furnaces, when used in the plural.

STAMP-MILL. A mill for crushing and concentrating minerals.

STAMP-ROCK. Rock containing fine copper that can be secured by crushing and jigging.

STAMPS. Machines to crush rock or ore by heavy blows.

STAMP-SHOE. The heavy chilled iron casting attached to the lower end of a stamp piston, that does the actual crushing of rock in a stamp-mill.

STANNIFEROUS. Tin-bearing.

STATION. A chamber in a shaft, cut out for pumps, etc.

STATION-PUMP. A mine pump permanently placed, as distinguished from a movable sinking-pump.

STEAM-HAMMER. A heavy hammer, actuated by steam or compressed air.

STEAM-STAMP. A stamp actuated by steam.

STEATITE. Soapstone. A greasy mineral, having a talc base.

STEP FAULT. A series of faults, rising like steps.

STOCKWERK. Country rock penetrated by numerous small stringers of ore, the entire mass averaging sufficiently rich to permit its mining and treatment.

STOPE. Used interchangeably to designate the excavation above a drift, or the pay-rock remaining unmined above a drift.

STOPING. Breaking down the mass of pay-rock or ore above a drift. When stoping in an ore body of average width, miners can break rock much more quickly and cheaply than when driving the drifts, which are about 7x7 feet in size.

STOPING GROUND. Ground in reserve, opened by drifts, and ready for breaking down.

STRATA. The successive rock layers of the earth.

STRATIFIED. Having regular layers of varying rock forms.

STRATUM. A layer or bed of rock.

STREAK. The color given by a mineral when scratched or rubbed on porcelain.

STRIKE. The horizontal trend of a mineral body, measured by the points of the compass; a discovery of ore.

STRINGER. A thin seam of ore.

STRIP. To remove the drift or alluvial soil overlying an ore body.

STRIPPING. The drift or alluvial soil overlying an ore body.

STRUCTURE. The form of a mineral, whether granular, crystalline or amorphous.

STUDDLE. A prop in a mine.

STULL. The top-piece of a set of mine timber.

SULPHATE. An ore of any metal or metals with which sulphur and water are united chemically.

SULPHIDE. An ore of any metal or metals with which sulphur is united chemically. Sometimes called a sulphuret.

SULPHOANTIMONITE. An ore of any metal or metals with which sulphur and antimony are united chemically.

SULPHOARSENITE. An ore of any metal or metals with which sulphur and arsenic are united chemically.

SULPHURET. A sulphide. Term becoming obsolete.

SUMP. The pit at the bottom of a shaft, where water collects.

SURFACE CAPTAIN. A mine superintendent whose duties are wholly on surface.

SURFACE RIGHTS. The ownership of the surface of land only, where mineral rights are reserved.

SWABSTICK. A stick used to clean out drill-holes.

SYNCLINAL. A syncline; of the nature of a syncline.

SYNCLINE. A trough formed by rock strata that are low in the center and high on the sides. The reverse of an anticline.

TABLE. An ore concentrator taking finely crushed particles of ore and gangue for separation.

TABLE LAND. A plateau.

TAILINGS. Refuse matter from a mill.

TAMP. To closely pack clay or other sticky earth into a drill-hole above the cartridges, to give greater force to the blast.

TAP. To draw off molten metal or slag from the vent of a furnace.

TAPER OFF. Cornish for stopping work temporarily.

TELERA. Spanish for a roast-heap of sulphide ore.

TENOR. The average metallic content of an ore, matte or impure metal.

TENSILE STRENGTH. The resistance to breaking or elongation offered by metal when under strain from either end.

TERRERO. Spanish for burrows of partly leached ore.

TERTIARY. Rock forms of the third great geological period.

TEST-PIT. A shallow pit sunk to discover mineral.

THROW. The vertical displacement of a vein caused by faulting.

TIMBER. The wooden beams and sticks used for underground supports.

TIMBER-BOSS. The head timberman.

TIMBERMAN. One who works at timbering a mine.

TON. See metric, long and short tons.

TONELADA. Spanish for long ton.

TOSSING. Jigging finely comminuted ore.

TOWN. See Range for description.

TRACHYTE. A micaceous hornblende and feldspar rock.

TRAM. To load rock or ore in tram-cars and push same to the shaft; a tramway.

TRAM-CAR. A car running underground, on T-rails, used for carrying rock from the stopes and other workings to the shafts.

TRAMMERS. Men who load and tram the broken rock underground.

TRAP. A dense gray, blue or greenish rock of volcanic origin; of considerable variety in different beds, but usually of feldspathic-augitic nature.

TRAPPEAN. Of the nature of trap.

TREND. The general direction of a mineral body.

TRESTLE. A frame-work of timbers, connecting various mine and mill buildings on surface, usually carrying tram-tracks.

TRIBUTE. The royalty or percentage paid by workmen to owners for the privilege of working a mine. Apt to be a form of grand larceny, at the expense of the mine's future.

TRIBUTOR. One who works a mine on tribute.

TRIPOD. The three-legged iron fame on which the working parts of a power-drill rest; a three-legged wooden frame over the mouth of a pit or shaft.

TROLLEY-CABLE. A wire rope sometimes used in an incline shaft as a guide for the bucket.

TROUBLED. A vein is troubled when disturbed or faulted.

TRUE FISSURE VEIN. All mineralized fissures are true fissure veins. Term commonly used as meaning a fissure vein with promise of holding to great depth, in contradistinction to a gash vein.

TSUBO. A Japanese measure of six feet square, equalling 36 square feet.

TUFA. A porous limestone. Name frequently used in place of tuff for rock of volcanic origin.

TUFF. Scoriaceous material from volcanic vents, solidified by time and superincumbent pressure. Tuffs range in density from porous pumice-stone to dense and exceedingly refractory conglomerates.

TUNNEL. A practically horizontal opening entirely through a hill or mountain. Term is commonly used instead of adit, which is a horizontal gallery having only one opening to surface.

TURBINE. The most efficient form of a water-wheel; also a new form of steam-engine in which the entire movement of the power producing parts is rotary instead of reciprocating.

TUYERES. The vents by which air is supplied, under pressure, to blast furnaces and bessemer converters.

UNCONFORMABLE. Rock strata that do not correspond as to bedding, or geological horizons.

UNDERHAND STOPING. Removing ore in descending steps.

UNDERLAY. The mineral bodies lying under a given tract, though not outcropping on surface.

UNDERLIE. The underlay.

UNPATENTED. Mining claims held from the United States Government, subject to annual assessment work.

UNSTRATIFIED. Rock forms not bedded in layers.

UNWATER. To free from water; to pump out.

UPCAST. A shaft having an upward air current.

UPRAISE. A raise.

VAN. To dress ore.

VANNER. A jig for dressing ore by means of vibratory motion, aided by jets of water to carry away gangue-rock.

VARA. A Spanish-American measure of length of 33 inches.

VEIN. A mineral body having defined walls. See contact vein and fissure vein.

VEINSTUFF. Ore with its associated gangue.

VENTILATION. The system of natural or artificial air currents in a mine. See air-shaft.

VERTICAL. Perpendicular. Upright and downright.

VERTICAL SHAFT. One sunk at an angle of 90° with the horizon, or directly downwards toward the center of the earth.

VINNEY. Cornish for copper ore with a green coating caused by weathering.

VIRGIN. Native metal occurring elementally, as distinguished from ores, which are chemical compounds.

VITREOUS. Of a glassy nature.

VOLATILE. That which can be driven off as vapor, by heat.

VUG. A druse. A hollow, or cave, entirely surrounded by rock. Usually shows fine crystallizations.

WALL. Rock of a different formation adjoining a vein or other ore body.

WATER DRILL. A power drill in which a current of water runs through the bit of a drill, changing the rock-dust from the bit into sludge, which is expelled from the bore-hole by the force of the current.

WATER-JACKET. An outer casing for a blast-furnace, in which water circulates, to keep the metallic furnace-walls from melting because of the intense heat of the charge.

WATER LEVEL. The ground water level is the point above which water does not rise when a mine is allowed to fill. The basic water level is the point below which altered and enriched ores are succeeded by base unaltered sulphides.

WEATHERED. Rock altered in structure by exposure to air and water.

WET PROCESS. Lixiviation.

WHEAL. Cornish for mine. Synonymous with **bal.**

WHIM. A windlass with a horizontal drum.

WHIP. A rope and fixed pulley or pulleys for hoisting.

WILFLEY. A Wilfley concentrating table.

WINCH. A windlass.

WINZE. A blind shaft, usually short, leading downward from a horizontal opening of a mine.

WINDLASS. A winding device for hoisting from a pit or shaft, by means of coiling a rope or cable around a drum.

WIRE BARS. Refined copper cast into bars for wire drawing.

WORKINGS. The underground openings of a mine.

ZINC BLENDE. Sphalerite. Sulphide of zinc.

ZINCIFEROUS. Carrying zinc.

ZINC SULPHIDE. Sphalerite.

CHAPTER XIV.

Copper Deposits of the United States.

Copper is found throughout the entire length of the Rocky Mountains, in Canada, the United States, Mexico and Central America, and in the cordillera of the Andes in South America from the extreme north to Punta Arenas on the Straits of Magellan. The North American copper deposits apparently are richer west of the main range of the Rockies, and the principal deposits, as a rule, occur in various isolated mountain ranges in the high tablelands between the Rocky Mountains and the Pacific. In the eastern part of the United States the Appalachian Mountain system carries copper ores from Maine to Alabama, the principal deposits occurring in the Green Mountains, Blue Ridge Mountains and Piedmont Mountains. In the Lake Superior district native copper is carried in the roots of an ancient mountain range. The mines of the United States furnish 55 to 60 per cent. of the total copper supply of the world. Occurrences of copper are treated by states, in alphabetical order.

ALABAMA. In the northeastern portion of Alabama the extension of the Ducktown district of Tennessee carries pyritic ores of a similar nature. Copper occurrences are noted in the counties of Cleburne, Clay, Coosa, Dean, Haralson, Marion and Randolph.

In Cleburne county considerable copper mining was done in the eighth decade of the Nineteenth Century. The Woods or Stone Hill mine showed a prominent gossan, with chalcocite in the secondary zone, succeeded by chalcopyrite at comparatively shallow depth. The ore was but slightly argentiferous and carried occasional sphalerite. The Smith mine, near the Woods, had a similar ore body.

Mines of cupriferous pyrites have been opened recently in Clay county, and copper ore is found near Goodwater in Coosa county. Cupriferous pyrites are being developed in Dean county. In Haralson county the Tallapoosa pyrite mine, about 25 miles east of Tallapoosa, shows lenses of slightly cupriferous iron pyrites.

ALASKA. The territory of Alaska is greater in area than France, Germany, Belgium, Holland and Denmark combined, and its copper deposits are scattered over a vast territory, in most cases but slightly explored. Transportation facilities are excellent for the coast mines, but lacking for the interior properties, which must have rail connections in order to become producers. The first important copper production was secured in 1904, from coast mines. The geography of Alaska remains somewhat vague as to the interior, by reason of the country being so vast, so sparsely populated and so slightly developed. It is known that certain tribes of aborigines possessed copper before the coming of the white man, and it is altogether probable that this copper was secured from the native deposits of the metal found in the Copper River country and adjoining fields.

The principal copper districts of Alaska, so far as now known, are those of Prince of Wales Island, Prince William Sound and the Copper River coun-

ry, the latter an immense district with numerous occurrences of ore and native copper. Alaska never has been organized as a territory, and has no counties, hence the difficulty in giving anything like exact limits to the districts of the interior.

The principal copper field of the present is the Prince William Sound district, which includes a long stretch of mainland and outlying islands. This district includes Latouche Island, Knights Island and the Ketchikan field. Nearly all of the mines are located within a mile or less of tide-water, and are enabled to ship their ores easily and cheaply to smelters along Puget Sound. The ore is mainly chalcopyrite, commonly associated with pyrrhotite and occasionally with pyrite, with a little chalcocite and malachite, occurring along shear zones and in sedimentary slates and altered lava flows called greenstones. As a rule, there are fairly strong gossans of slight depth. Latouche Island has several promising properties that are shippers, and the Bonanza mine has a large ore body outcropping on a mural escarpment near the sea. Knights Island shows promising sulphide ores in greenstone and associated rocks of the Orca series. Glacier Island also shows ore of promise. Ketchikan is the principal town of this district.

Several mines have been developed on Prince of Wales Island, mainly on contact deposits between limestone and intrusive diorite or greenstone. Below a shallow zone of oxidation the ore is mainly chalcopyrite, associated with magnetite, in lenses up to 40 feet width and 150 feet length, the chalcopyrite carrying one to two dollars gold per ton, with small silver values.

The Copper River country includes a number of sub-districts of large area, around the headwaters of the Copper, Tanana, Shusitna and White rivers, including portions of the Wrangell, Chugatch and Alaskan mountain ranges. The Copper River basin is a broad syncline, the central part of which is occupied by the Wrangell Mountains, of Tertiary age. The most prominent rock formation is the Nicholai greenstone, associated for about 300 miles with Permian limestone. The Nicholai formation consists mainly of amygdaloidal flows, resembling those in the Lake Superior district, and carries native copper and secondary sulphides. The flows are mainly altered basalts, containing considerable metallic copper in fissures, or in sedimentary rocks near the point of contact with the traps. Copper occurs native and as oxides in shear zones, or as chalcocite and bornite in veins in greenstone. Bornite, which is the principal ore, is slightly auriferous and argentiferous.

The basin of the Kotsina River, in the Copper River district, shows native copper with quartz gangue, near the basal flows of the greenstone series, filling amygdules in greenstone and associated with epidote, as in the Lake Superior district, there being a little bornite and chalcopyrite in connection with the native copper. This district is about 125 miles northeast of Valdez.

The Chitna district shows numerous occurrences of sulphide ores, with native stream copper along the valley of the river, and between the river and Mount Wrangell. On Nugget Creek, a tributary of the Kuskulana River, a mass of native copper reported as three by eight feet in size was found. Native copper is found on the headwaters of the Nizinà River.

Numerous copper occurrences are noted on the headwaters of the White River, and small masses of native metal weighing up to ten pounds have

been found in greenstone dykes, said to traverse limestone and schists. T veins are small, and those noted seem of small importance. Along Kla Creek, near Scolai Pass, on the divide between the White and Chitna Riv native copper occurs as stream metal, evidently derived from ancient b saltic dykes intersecting diorite and Carboniferous limestone. Most of t valley is overlaid with a deposit of volcanic ash, up to one hundred feet depth.

Native copper is reported from the Kenai Peninsula and the Turna Arm district, and copper sulphides occur in metamorphic rocks in the K Peninsula. Copper ores are reported from Resurrection Bay and Lynx Cr 50 miles north of Seward, and on the Knik River and Lake Iliama, west Cook Inlet.

ARIZONA. Arizona is the second district of the United States and the world in point of copper production, ranking second only to Montan No other copper field has shown such heavy gains in production during th past decade, and there is none with brighter prospects for the future. About one-sixth of the copper mines of the United States are found in Arizona, and of this number many are of very doubtful value, while a few are of thoroughly demonstrated worth, and a considerable number are properties of much promise.

There are evidences of rude mining operations by prehistoric peoples at a number of points, but no traces of smelting, and, had the copper ores been reduced, the slags and possibly remnants of the furnaces scarcely could have escaped attention. It seems probable that azurite, malachite and ochrous iron were mined, in a crude way, for pigments, and prehistoric turquoise mines have been found at several points, notably in the Dragoon Mountains.

The first copper smelter of Arizona, built of adobe bricks, is said to have been located at the Ajo mines, in Yuma county, about 40 miles southeast of Gila Bend, and to have been operated by P. R. Brady and others, immediately after the Gadsen Purchase, in 1852. In 1873 copper production was begun from the Longfellow mine, near Clifton, Graham county, with an adobe furnace.

There are numerous copper districts in the various counties, these having, as a rule, a generally southeasterly and northwesterly trend, with copper deposits commonly on or near the contacts of igneous rock with Paleozoic limestones, mainly of the Carboniferous series. The greater portion of Arizona is included geologically in the Sonoran Plateau, with conditions much the same as in the adjoining Mexican state of Sonora.

Central and southern Arizona form a plateau of 1,000 to 5,000 feet elevation, grading to nearly sea-level along the western edge, with numerous isolated mountain ranges. Apparently this part of Arizona emerged from the seas late in the Tertiary age.

Arizona has copper mines, or attempts at mines, in the counties of Apache, Cochise, Coconino, Gila, Graham, Maricopa, Mohave, Pima, Pinal Santa Cruz, Yavapai and Yuma, this list including every county in the territory. The principal districts, in order of importance, are the Warren district at Bisbee, Cochise county, the Greenlee district of Graham county, the Globe district of Gila county and the Jerome district of Yavapai county

All of the more common oxidized and sulphide ores are noted, and there is considerable native copper, occurring as masses up to some hundredweights in size, and as finely comminuted native metal in the fluccan, which is heavy along the walls. The principal ores are disseminated chalcocite and chalcopyrite, the chalcocite usually being associated with manganese in a talc gangue, and being the source of more than half of the total copper production of the district. There are small but appreciable values in silver and gold, and to the northwestward of the cupriferous crescent are lead ores, and, in fact, Bisbee was a lead camp previous to the opening of the copper deposits of the Copper Queen mine, in 1880. The zone of oxidation is most erratic, and full oxidation is noted to the greatest depth yet reached, which is nearly a quarter-mile. The secondary sulphides are found with oxidized ores above and below, and even the unaltered sulphide, chalcopyrite, is sandwiched between oxidized ores and native copper, in a most confusing manner. Indications are not especially promising either north or south of the cupriferous crescent, though narrow fissure veins, containing high-grade ores, are noted in the granite-porphyry for nearly the entire length of the range.

In Coconino county there are promising copper outcrops on the southern plateau of the Grand Cañon of the Colorado River, and several small mines have produced limited quantities of ore, mainly rich carbonates, with occasional chrysocolla and a little chalcocite. There also are developing copper mines in the vicinity of Flagstaff, and at Ryan, in the northern part of the county, near the Utah line.

The first mines in the Globe camp of Gila county were opened for silver, in 1874, and were closed in 1877, copper mining beginning in the following year. The pioneers suffered severely from raids of the Apaches, and worked under great economical disadvantages, due to poor transportation facilities and expensive fuel. Oxidized ores only were smelted until 1902, when sulphide smelting was introduced. The geological base of the Globe district is the Pinal schist, of pre-Cambrian age, succeeded by the Apache group of pre-Cambrian rocks and the Globe limestone, including beds of age from Devonian to upper Carboniferous, faulted by the Gila conglomerate of Tertiary age. After the laying down of the Gila conglomerate there was much faulting and compression, with marked metamorphism, with a complex of eruptives enjoying a great variety of lithological cognomens, according to the fancy of the geologists. Roughly speaking it may be said that a limestone and diabase contact shows ore bodies occurring as irregular lenses, practically parallel with the horizontal bedding planes of the limestone series, up to nearly 600 feet in thickness, resting on quartzite.. The Old Dominion fault is a very prominent geological landmark, ore occurring mainly on the southern side. There are fissure veins and fault-fissures, but many fissures are not all mineralized. The average strike of the veins is approximately northeast and southwest, with dips of 40 to 90 degrees. The ore bodies may be divided into three classes, these being irregular masses in limestone, fissure veins, and irregular mineralizations of the permeable rocks. Ores are mainly oxidized, but with occasional occurrences of sulphides, which may have oxidized ores below as well as above. The oxidized ores carry considerable hematite in their gangue, but are highly silicious and require heavy fluxing with iron as well as lime. The shortage of sulphide ores needed to furnish iron for fluxing the oxidized

ores is a drawback to the field. The Globe district is quite extensive in area, and the Gibson property shows veins of very high-grade massive secondary sulphides, in schist. Copper developments are under way in the San Carlos and Christmas districts, and elsewhere in Gila county.

The Greenlee district, in which are found the mining towns of Clifton, Morenci and Metcalf, is known commonly as the Clifton district, and is the oldest of the present important copper fields of Arizona, dating from 1872, and also is notable for the invention of the water-jacket blast-furnace. This district is second in Arizona as a producer, but is second to none in size of its ore bodies, though the ore, while occasionally found in high-grade fissures, is mainly of low copper tenor. The Arizona and Detroit mines are working low-grade ore bodies carrying 3 to 4 per cent. copper only, and the future of the district rests mainly on extensive development of ore bodies of even lower average tenor.

The geology of the Clifton district probably is more complex than that of any other important copper field of the world, and would require a monograph of a hundred pages or more for a complete exposition. A most critical and exhaustive study of this field has been made by Prof. Waldemar Lindgren, of the United States Geological Survey, and his report thereon is a monumental work. The Clifton district may be described as a geological island of pre-Tertiary granite-porphyry, quartzite and limestone, surrounded by lava flows and a sedimentary series of Paleozoic age, including quartzite and conglomerate, upon which is imposed about 800 feet of limestone beds of Silurian, Devonian and Carboniferous ages, intruded by porphyry and partially covered with flows of rhyolite and andesite. The porphyry is essentially a monzonite and much of it is workable as an ore of low grade. Contact metamorphism apparently is responsible for most of the extensive mineralization, though there are evidences at many points of secondary enrichment. The oxidized zone extends from surface to a depth of 50 to 200 feet, usually carrying oxidized ores of greatly varying tenors, though sometimes barren. The zone of secondary sulphides is 100 to 500 feet in depth, carrying chalcocite and bornite, succeeded by the pyritic zone carrying chalcopyrite and sphalerite, associated with pyrite. The ores of the pyritic zone are low in copper tenor, and difficult of reduction, because of the considerable quantities of zinc associated therewith, but this zone contains enormous quantities of ore, which, without question, will be extracted in the future. The ore bodies include oxidized ores occurring in irregular forms near contacts, also fissure veins of sulphide ores in the porphyritic zone, and contact deposits in prophyry. There also are stockwerks, carrying veinlets of disseminated chalcocite, these occuring mainly in porphyry, but occasionally in quartzite. The cupriferous monzonite may be considered the predominant ore deposit, this containing finely disseminated chalcocite in a highly altered monzonite-porphyry, with the gangue ranging from quartz to talc. Considerable brochantite is produced, this being one of the few districts where brochantite is found as a commercial ore. The rich oxide and carbonate ores of early days are practically exhausted, in the older and larger mines, but oxidized ores low in copper tenor are treated by leaching, this being one of the very few American copper fields in which leaching processes are employed successfully. The average of all ores treated in the district is about 3.5 per cent. copper and 18 cents gold per

short ton, while the oxidized ores treated by the Arizona Copper Co. average under 3 per cent. copper, and are the lowest in grade of any copper ores treated at a profit in Arizona.

In addition to the mines of the Greenlee district there are small copper properties elsewhere in Graham county, notably at Fort Thomas, Fort Grant, Pima, Safford, Solomonville and Willcox.

Maricopa county has a considerable number of developing mines, of various degrees of promise. The principal copper mining districts are found at Wickenburg, Cave Creek and Morristown.

Mining operations in Mohave county have been mainly for the precious metals, but there are a number of developing copper mines in the vicinity of Kingman and Chloride, and copper properties of considerable promise are noted along the Colorado River, and on the Bill Williams Fork River that forms the boundary line between Mohave and Yuma counties.

Navajo county has no copper producers, but there are ore bodies apparently worthy of serious investigation. On the Navajo Indian Reservation, shortly south of the Utah line, Triassic sandstones show a stratum carrying chrysocolla and occasional melaconite, as speiss and nodules, rich but very erratic in occurrence.

The principal producing copper field of Pima county is the Silver Bell district, though production has begun from the Pima district. The principal mining fields of the county are found in the Sierrita, Santa Rita and Santa Catalina mountains. In the latter district, near Tucson, more or less exploratory and development work has been done for about seven miles. The mountains show a granitic core, with quartzite and limestone sedimentary beds, cut by intrusive dykes of diabase, with ore occurrences along the dykes.

The Silver Bell district is in the Silver Bell Mountains, a small, isolated range of less than 3,000 feet elevation. The hills have granite bases, with quartzite and limestone strata superimposed, the latter being much eroded, with the usual intrusive rocks, the ore bodies occurring as irregular masses with prominent gossans, in porphyry shear-planes, and in limestone and granite-porphyry, near the contacts. The ores are mainly chalcopyrite and bornite.

The Pima district, on the slope of the Sierrita Mountains, was mined first in 1880, for silver-lead ores. This district shows large bodies of low-grade ore in limestone, and occasionally in porphyry, along the contact of these rocks, the ore usually having a limestone gangue, there being intrusive quartzites.

In the Santa Rita Mountains the Helvetia district shows Carboniferous limestone strata, with prophyritic intrusions, the ore bodies showing good gossan outcrops.

Pinal county, while having no large copper producers, has several districts of decided promise, and should become an important copper field, with further development. The Ray or Kelvin district shows a zone of approximately one mile width, with a length of at least three miles, in which occur banded acid igneous rocks, giving strong evidences of thermal alterations and silicification, carrying chalcopyrite coated with chalcocite, in small particles and thin veinlets, with gangue of country rock, and also

showing occasional bunches of ore of fair size. The surface showing of gossan throughout this zone is good, and apparently copper continues into the diorite to the westward of the zone. There are no sedimentary rocks in or near the principal copper zone. A little high-grade ore is noted at points, but, as a rule, the ore is low in copper tenor, though in tremendous quantity. The Mineral Creek district, near Ray, shows silicious and argillaceous shales and quartzite, with intrusive dykes of granite-porphyry, the quartzite being much faulted and brecciated along fault-planes. Carbonate ores of varying tenor are found throughout the district.

The Christmas district, on the Gila River, shows oxidized and sulphide ores, in altered limestone near porphyritic intrusives, ore being mainly chalcopyrite, associated with a profusion of magnetite.

The Pioneer district, sometimes called the Superior district, was worked originally for gold. The principal copper property in this district has two contact veins, between quartzite and limestone, carrying silicious oxide and carbonate ores, more or less auriferous and argentiferous, with occasional free gold, and associated with iron and manganese.

The Casa Grande district shows ore of good average tenor, and copper ores of more or less promise are noted at various other points in the county.

Santa Cruz is the smallest county in Arizona, lying near the Mexican border. Principal developments are in the Patagonia Mountains, where there are several mining districts. This mountain range shows the characteristics common to practically all of the isolated ranges of the Sonoran Plateau, and ore bodies occur mainly as contacts between limestone and porphyritic rocks, or in the limestone near the point of contact. The copper ores usually are auriferous and argentiferous, and in most cases are associated with galena and sphalerite, the latter causing considerable trouble in reduction.

The county of Yavapai in area would put to blush several of the smaller kingdoms of Europe, and is mineralized in all of its mountain ranges. This county is the principal gold district of Arizona, and shows copper ores, of more or less promise, in practically every one of its numerous mining districts. There are copper mines, or attempts at mines, near Big Bug, Briggs, Carrollton, Cherry, Crown King, Dewey, Gilbert, Granite, Groom Creek, Humboldt, Huron, Jerome, Kirtland, Maxton, Mayer, McCabe, Middleton, Minnehaha, Poland, Providence, Prescott, Stoddard and Turkey. The only important copper producer is in the United Verde mine, at Jerome, though the Bradshaw Mountains have small producers of promise, and there are other fields in which development work is under way.

The Verde district, which includes Jerome, is very rugged. The district was fissured and faulted, then cut transversely, at nearly right angles, by dykes, followed by extensive mineralization, apparently by metasomatic action. The country rock is a schistose slate, extensively intruded by igneous dioritic rocks, with an unconformable capping of limestones and sandstones of later age devoid of copper. The veins at Jerome and to the southward show strong gossans and promising surface indications, but many attempts at developing mines have resulted in the making of no important producers except the United Verde. This property shows two ore bodies separated by low-grade ore and a quartzite dyke very rich in gold

and silver. There is a limited zone of oxidized ores, largely worked out, but the principal values are in disseminated sulphides.

Yuma county was accessible with such difficulty, until the building of the Arizona & California railroad, in 1906, that copper mining developments have lagged, though there are notable deposits of copper ore along the Colorado and Bill Williams Fork rivers. The Empire Flat district shows schist and limestone beds with intrusive granite, carrying fissure veins with strong gossans. The ores are of great variety, and exceptional richness, including considerable chrysocolla in the oxidized zone, and secondary sulphides of high average tenor. The district around Empire Landing, about 75 miles above Empire Flat, is partly in Yuma county, Arizona and partly in San Bernardino county, California. Although explored slightly during the preceding twenty years, development may be said to date from the advent of a railroad, in 1906, though some copper ore was mined and shipped by way of the Colorado River to Swansea, in early days. There are ore occurrences of considerable promise in this district.

ARKANSAS. Copper ores are noted sparingly throughout the Ozark uplift, and copper deposits are found in the counties of Baxter, Garland, Montgomery, Marion, Pulaski, Searcey and Sevier. The ore as a rule is chalcopyrite, and quite commonly is associated with galena and sphalerite. The lead and zinc deposits of the Ozark region apparently are of greater promise than the copper ores. Tetrahedrite and tennantite are noted ten miles north of Little Rock, in Pulaski county.

CALIFORNIA. Few states in the Union are more richly endowed with copper. The first discovery, made in 1840, when California was a portion of Mexico, was near El Paso Soledad, in what is now Los Angeles county, and in 1854 a little copper was produced therefrom. In 1855 copper was discovered in Alpine county, but the Napoleon mine, in Calaveras county, discovered and opened in 1860, was the first Californian copper producer of importance. There was a copper boom in 1862 and 1863, with hundreds of stock companies organized, and between 1863 and 1866, nine small copper smelters were built in the state, the local production being about two million pounds in 1864, in addition to considerable shipments of ore to Swansea, Baltimore and New York. After 1868 the industry was practically non-existent, until 1896, when the Iron Mountain mine, under English management, became an important producer. The high-water mark of production was reached in 1901, with an output of 34,931,985 pounds fine copper, in which year Shasta county produced 30,990,781 pounds, with between one and two million pounds each from Calaveras and Fresno counties, the balance of the output being composed of the small contributions of fifteen other counties. In 1900 California stood fourth among the copper producing fields of the United States.

There are occurrences of copper ore in about fifty of the fifty-seven counties of California, and there are copper mines of more or less importance in the counties of: Alameda, Alpine, Amador, Calaveras, Colusa, Contra Costa, Del Norte, El Dorado, Fresno, Humboldt, Inyo, Kern, Lake, Lassen, Los Angeles, Madera, Marin, Mariposa, Mendocino, Merced, Mono, Nevada, Placer, Plumas, Riverside, San Bernardino, San Diego, San Luis Obispo, Santa Clara, Shasta, Siskiyou, Sonoma, Tehama, Trinity, Tulare and Tuolumne.

The copper fields of the state may be divided into four groups, of which the first in productive importance is in Shasta county, the second in the Sierra Nevadas, the third along the Coast Range Mountains, and the fourth in the desert region of Southern California, near the Nevada and Arizona lines. The Sierra Nevada copper belt stretches along the western flanks and foothills of the mountains, showing practically continuous occurrences of copper for nearly 400 miles, reaching from Oregon on the north to nearly the Lower California line. This field contains many old mines, and is a district of much promise. The Coast Range field shows copper deposits for about 150 miles southward from the Oregon line, but the principal occurrences and developments are in Siskiyou and Del Norte counties, on the Oregon boundary. The southern extension of the Coast Range belt also shows copper ores in San Diego and adjoining southern counties. In Kern county there is an apparent branching of the Sierran copper range, with an offshoot that traverses Inyo and San Bernardino counties, reaching over into the neighboring territory of Arizona, thus establishing a close geographical and geological connection between the copper measures of southeastern California and central western Arizona. The mines of Shasta county are of preponderant importance, Calaveras county in the Sierra Nevadas coming second, with Fresno third, and with important developments under way in Siskiyou and Del Norte counties.

As a rule the alteration zone of Californian copper deposits is comparatively shallow, showing oxidized ores of high grade in profusion at surface, usually succeeded by unaltered chalcopyrite at an average depth of about one hundred feet only.

The copper district of Shasta county, as developed, is a crescent of two to three miles average width by about thirty miles extreme length. The principal developments are in the western third of the crescent, though there are properties of promise to the eastward. This district shows an extensive series of sedimentary rocks ranging in age from Miocene to Devonian, associated with igneous rocks of various ages, intercalated with the sedimentaries, or more commonly occurring as intrusives. The western end of the crescent shows slate to the west with granite-porphyry and quartzite to the east. Copper ores occur as sulphide deposits in contact zones and shear zones and a wide and irregular belt of igneous rocks runs from Iron Mountain past Bully Hill, traversing a series of sedimentaries ranging from Devonian up to nearly the top of the Triassic series. A large portion of this rock is volcanic, embracing acid and basic lavas, with fossiliferous tuffs. The entire district is much faulted and sheared, with sulphide ore bodies occurring in shear zones ranging up to hundreds of feet in width. These lenses are usually flat-lying, with chalcopyrite disseminated in pyrite, almost invariably auriferous, but low in copper tenor. The gossan cappings are massive, and large bodies of silicious ore are lacking. The Iron Mountain mine was worked originally for gold and silver values in the gossan.

In Calaveras county the principal developments are in the vicinity of Copperopolis, where mining has been done, more or less regularly, for many years. The ore bodies occur in black pyritous slate, in a bed of amphibole schist, the geological horizon being the same as at the gold mines of the Mother Lode, twelve miles eastward.

Along the coast there are important deposits of cupriferous pyrites in the suburbs of Oakland, Alameda county, on San Francisco Bay, and copper has been found in sewer digging on Connecticut street, between Eighteenth and Mariposa streets, in the city of San Francisco.

Santa Clara county has promising copper deposits in the vicinity of the New Almaden quicksilver mines. Copper was discovered in Los Osos district of the Coast Range Mountains, San Luis Obispo county, in 1854. In San Diego county copper occurs in the Encinitas district, and at various other points.

In the desert country of southeastern California, comprised mainly in the counties of Inyo and San Bernardino, copper occurs at numerous points. The Ubehebe district of Inyo county shows promising surface indications and rich ores at several points. The Death Valley region of Inyo county was the scene of a copper boom in 1906-1907, when many mining companies were organized, and considerable work was done in the Greenwater district, which lies on the flanks of the Funeral Range, east of Death Valley. The formation of the Greenwater district consists of underlying granite-porphyry, with rhyolite flows and tuffs, the summits of the mountains being capped by remnants of basaltic flows, with no sedimentary rocks known as yet. The mineralized belt is about 30 miles in length, and ores, as found, are mainly of high average tenor, highly silicious, occurring in shear zones in granite, having a generally southwesterly trend, in streaks of one to three feet in width. The Greenwater district has proven disappointing.

COLORADO. Nearly one-third of the refined copper produced by Colorado smelters comes from ores mined in other states and territories, and upwards of half of the copper production from Colorado mines comes from Leadville, in Lake county, where the principal mineral products are lead, silver and zinc, but at depth there is a marked increase in copper values, and it is possible that Leadville may become a copper camp of importance, in time. Practically the entire copper output of the state is secured as a by-product from silver-lead and zinc ores. With the exception of a plateau in the eastern half of the state, Colorado is heavily mineralized throughout the mountains, but as a rule the geological conditions are not so favorable to the occurrence of large bodies of copper as in most of the other mountain states. Outside of the Leadville district the most promising copper fields seem to be in Larimer and Routt counties. There are copper mines, or mines carrying considerable copper values, in the counties of Boulder, Chaffee, Clear Creek, Costilla, Custer, Delta, Dolores, Eagle, El Paso, Frémont, Gilpin, Grant, Gunnison, Hinsdale, Huerfano, Jefferson, Lake, LaPlata, Larimer, Mesa, Montrose, Ouray, Park, Pitkin, Routt, Saguache, San Juan, San Miguel, Summit and Teller.

Larimer county shows numerous copper deposits near the Wyoming line, the Pearl district, lying about 20 miles southeast of Encampment, Wyoming, being the most important. The geology of the Pearl district is much the same as that of Encampment, except that quartzite is lacking, the prevalent rock formation being granite masses cut by pegmatite dykes. The ore is mainly chalcopyrite, associated with considerable quantities of sphalerite.

The Silverton mines of San Juan county produce considerable copper ore as a by-product from silver mines, San Juan county, ranking second

to Lake county in the state, as a copper producer, with an average yearly output rising two million pounds of fine copper.

CONNECTICUT. The first copper mine in the United States was opened at Granby, Hartford county, Connecticut, in 1705, this being the Newgate mine. The Bristol mine in the same county also was a producer. The Bristol yielded mainly chalcocite, bornite and chalcopyrite, with a little malachite from the upper portions and was opened in a fault zone between gray gneiss, hornblende schist and Triassic sandstone. Native copper is noted at Farmington, in the same county, and there are occurrences of copper ore at New Britain and Simsbury, the latter being cupriferous pyrites, which also occur in Hartford county. Native copper occurs at Farmington, in red sandstone. A 200-pound mass of native copper has been found in alluvium, near New Haven, and there are sulphide copper ores at Carmel Centre and Cheshire, in New Haven county. Copper ores are noted also at Brookfield in Fairfield county, Roxbury in Litchfield county, Middletown in Middlesex county, Bolton in Tolland county, and Montville in New London county.

DELAWARE. No workable deposits of copper ore are known in this state, but chalcopyrite has been found in a granite quarry on the Brandywine river, near Wilmington, New Castle county.

FLORIDA. Small veins of sulphide copper ores are reported from several points in Florida, but no workable copper deposits are known.

GEORGIA. A little copper mining was done in the Ducktown belt, circa 1870-1875. Fannin county carries the eastern extension of the Ducktown copper belt of Polk county, Tennessee, and the No. 20 mine, between Pierceville and Frytown, has a 20-foot vein of sulphite ore giving assays of 3 to 30 per cent. copper, and with the usual oxidized ores in the upper portion.

Lincoln county has gold, silver and copper ores at various points. The Seminole mine has three veins in a 300-foot shear zone in mica-schist, cut by diabase dykes. The ore is chalcopyrite, associated with galena, sphalerite and pyrite, in chutes averaging about 3 feet with a maximum width of 8 feet. The richer ores carry seven to twenty dollars gold and silver per short ton.

The Chestatee mine, six miles from Villa Rica, in Carroll county, has a bedded vein of cupriferous pyrite 20 to 30 feet in width, with pay-streaks along either wall, and has an outcrop traceable for about 2,000 feet. This vein is said to assay about 3 per cent. copper, but probably does not average more than about half that amount.

In addition to the occurrences noted in the preceding counties, copper ores are found in the counties of Cherokee, Haversham, Rabun and Wilkes.

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Along the coast there are important deposits of cupriferous pyrites in the suburbs of Oakland, Alameda county, on San Francisco Bay, and copper has been found in sewer digging on Connecticut street, between Eighteenth and Mariposa streets, in the city of San Francisco.

Santa Clara county has promising copper deposits in the vicinity of the New Almaden quicksilver mines. Copper was discovered in Los Osos district of the Coast Range Mountains, San Luis Obispo county, in 1854. In San Diego county copper occurs in the Encinitas district, and at various other points.

In the desert country of southeastern California, comprised mainly in the counties of Inyo and San Bernardino, copper occurs at numerous points. The Ubehebe district of Inyo county shows promising surface indications and rich ores at several points. The Death Valley region of Inyo county was the scene of a copper boom in 1906-1907, when many mining companies were organized, and considerable work was done in the Greenwater district, which lies on the flanks of the Funeral Range, east of Death Valley. The formation of the Greenwater district consists of underlying granite-porphyry, with rhyolite flows and tuffs, the summits of the mountains being capped by remnants of basaltic flows, with no sedimentary rocks known as yet. The mineralized belt is about 30 miles in length, and ores, as found, are mainly of high average tenor, highly silicious, occurring in shear zones in granite, having a generally southwesterly trend, in streaks of one to three feet in width. The Greenwater district has proven disappointing.

COLORADO. Nearly one-third of the refined copper produced by Colorado smelters comes from ores mined in other states and territories, and upwards of half of the copper production from Colorado mines comes from Leadville, in Lake county, where the principal mineral products are lead, silver and zinc, but at depth there is a marked increase in copper values, and it is possible that Leadville may become a copper camp of importance, in time. Practically the entire copper output of the state is secured as a by-product from silver-lead and zinc ores. With the exception of a plateau in the eastern half of the state, Colorado is heavily mineralized throughout the mountains, but as a rule the geological conditions are not so favorable to the occurrence of large bodies of copper as in most of the other mountain states. Outside of the Leadville district the most promising copper fields seem to be in Larimer and Routt counties. There are copper mines, or mines carrying considerable copper values, in the counties of Boulder, Chaffee, Clear Creek, Costilla, Custer, Delta, Dolores, Eagle, El Paso, Frémont, Gilpin, Grant, Gunnison, Hinsdale, Huerfano, Jefferson, Lake, LaPlata, Larimer, Mesa, Montrose, Ouray, Park, Pitkin, Routt, Saguache, San Juan, San Miguel, Summit and Teller.

Larimer county shows numerous copper deposits near the Wyoming line, the Pearl district, lying about 20 miles southeast of Encampment, Wyoming, being the most important. The geology of the Pearl district is much the same as that of Encampment, except that quartzite is lacking, the prevalent rock formation being granite masses cut by pegmatite dykes. The ore is mainly chalcopyrite, associated with considerable quantities of sphalerite.

The Silverton mines of San Juan county produce considerable copper ore as a by-product from silver mines, San Juan county, ranking second

to Lake county in the state, as a copper producer, with an average yearly output rising two million pounds of fine copper.

CONNECTICUT. The first copper mine in the United States was opened at Granby, Hartford county, Connecticut, in 1705, this being the Newgate mine. The Bristol mine in the same county also was a producer. The Bristol yielded mainly chalcocite, bornite and chalcopyrite, with a little malachite from the upper portions and was opened in a fault zone between gray gneiss, hornblende schist and Triassic sandstone. Native copper is noted at Farmington, in the same county, and there are occurrences of copper ore at New Britain and Simsbury, the latter being cupriferous pyrites, which also occur in Hartford county. Native copper occurs at Farmington, in red sandstone. A 200-pound mass of native copper has been found in alluvium, near New Haven, and there are sulphide copper ores at Carmel Centre and Cheshire, in New Haven county. Copper ores are noted also at Brookfield in Fairfield county, Roxbury in Litchfield county, Middletown in Middlesex county, Bolton in Tolland county, and Montville in New London county.

DELAWARE. No workable deposits of copper ore are known in this state, but chalcopyrite has been found in a granite quarry on the Brandywine river, near Wilmington, New Castle county.

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been worked for years in the western part of the Cœur d'Alene belt, no serious attempts at copper mining were begun until 1898. This district now has one considerable producer, and a number of developing mines of promise. The Snow Storm mine, on Stevens Peak, near the Montana boundary, shows an impregnated cupriferous zone conforming to the bedding planes in Algonkian quartzite. The ore body, as developed, is 10 to 35 feet in width and upwards of 400 feet in length. The usual oxidized ores above are succeeded by chalcocite and bornite, disseminated in quartzite, with occasional bodies of chalcopyrite. The ore body as a whole averages about 4 per cent. copper, 6 ounces silver and $2 gold per short ton, the ore being highly silicious and devoid of iron and alumina.

The Seven Devils and Snake River copper districts lie mainly in Washington county, Idaho, though with extensions on the west into Baker county, Oregon. These districts have been worked spasmodically since about 1888, the lack of adequate transportation facilities precluding regular operation. The Seven Devils district shows numerous copper deposits, over a considerable area. There is an extensive series of Triassic basic lavas, with intercalary slate and limestone, intruded by diorite, all of the igneous rocks being cupriferous, ores occurring mainly as primary and secondary sulphides, largely the latter, in fissure veins, contact veins and impregnation zones, most of the ore bodies carrying considerable garnet, epidote and calcite. In the Snake River district the ores are mainly malachite, bornite and chalcopyrite, occuring usually as contact deposits between limestone and dioritic rocks, garnet and epidote being characteristic associated minerals.

In the vicinity of Mackay, in Custer county, there are several mines, of which one is of some importance. Much work has been done at this point, but the best results were not secured, owing to the vacillating policy of the principal company. The ore is of low average grade, but exists in large quantities.

Bannock county, in the extreme southeastern part of the state, shows copper ores, occurring in vejns and lenses in greenstone, schist and conglomerate near limestone, the ores being both auriferous and argentiferous.

Copper ores are noted at various points in Lemhi county, notably in the Black Bird district, about 30 miles west of Salmon City, where there are well defined fissure veins, and an impregnation zone in mica-schist intruded by granite.

ILLINOIS. Float copper, in alluvium brought from the Lake Superior district by glacial action, is of rather common occurrence in Illinois, and deposits of copper ore in place have been found in the counties of Chittenden, Hancock and Hardin.

INDIANA. Occasional small pieces of native copper, brought in drift from the Lake Superior district, are found in alluvium in this state. The occurrence of copper ore in an oil-well drilled six miles northwest of Marion, Grant county, was reported, but not verified, in 1904.

IOWA. The only reported occurrences of copper in Iowa are occasional small pieces of native metal found in drift, evidently brought by glacial action from the native copper deposits of Lake Superior. It is probable

that occasional chalcopyrite would be found in lead mines near Dubuque, if a close watch were kept for such ore.

KANSAS. Occasional chalcopyrite is found in the lead and zinc mines of Galena, Cherokee county, in southeastern Kansas. The rock strata of Kansas range from Carboniferous to Tertiary, but igneous rocks being lacking, there seems slight likelihood of the existence of copper deposits of commercial importance.

KENTUCKY. Chalcopyrite occurs in Livingston and Union counties, and copper ore was reported, in 1902, from the vicinity of Richmond, Madison county, but none of these occurrences seem of commercial importance.

LOUISIANA. The only known occurrence of copper ore in this state is in a peak deposit of galena, sphalerite and barite, in halite, on Belle Isle, near the mouth of the Atchafalaya river, in Iberia parish.

MAINE. There are occurrences of copper ore in the counties of Hancock, Penobscot, Sagadhoc and Washington, there being old copper mines near Calais, Washington county, on the New Brunswick border.

Occurrences of copper are noted in Brookville, Sullivan, Blue Hill and Franklin, in Hancock county, the more important being in the vicinity of Blue Hill, where there have been about a dozen attempts at actual mining, mostly unimportant, though several small mines were opened. This county had a copper mining boom, circa 1877, at both Blue Hill and Sullivan, mining being suspended about 1884, on account of the low price of the metal. The copper slump of 1907 came just in time to nip in the bud an attempt at reopening some of these old mines. At one time there were two mining exchanges in Bangor, but at last accounts these buildings were occupied as a saloon and barber shop, respectively. The Blue Hill ores were claimed to run 5 to 30 per cent copper, with an average of 10 to 12 per cent, which obviously is a great exaggeration, and the ores were claimed to average $12 to $15 gold per ton, also an obvious exaggeration. The old waste-dumps are said to average 3 to 4 per cent. copper.

MARYLAND. Small copper mines were operated in Maryland in colonial days and during the first half of the Nineteenth Century, the copper industry of Maryland being of some importance until the suspension of mining was brought about by the discovery and exploitation of the Lake Superior mines. The copper ores of Maryland are mainly chalcopyrite, with occasional chalcocite and bornite, and a small amount of malachite. There are three copper belts, in the three counties of Baltimore, Carroll and Frederick.

The most important copper district of the state is in Frederick county, where there is a cupriferous belt running along the Linganore hills, from New London northward to a point beyond Libertytown. This district shows chalcopyrite with occasional chalcocite and bornite, in dolomitic limestones and micaceous schists.

The second district, in Carroll county, is a fault-zone, traceable by occasional outcrops for a distance of about 25 miles, the principal operations of the past having been between Sykesville and Finksburg. The predominant rock form is slate, and the ore is mainly chalcopyrite, with some chalcocite and bornite.

The third district, in Baltimore county, shows copper ore within the city limits of Baltimore, but the principal mines are found at Mount Washington, in the Bare Hill district, a few miles northwest of Baltimore, where there is a vein of 2 to 5 feet width, in hornblende gneiss, near intrusive peridotite.

MASSACHUSETTS. In this state copper ore is noted in the counties of Berkshire, Essex, Franklin, Hampden, Hampshire, Norfolk and Worcester. A little native copper is found in some of the Triassic sandstone strata, and a little chalcopyrite is found in the lead mines of Southampton, in Hampshire county. In Franklin county, the Davis pyrite mine has been worked for sulphur values since circa 1880. Two miles west of the Davis mine is a Savoy schist, carrying a fahlband of 15 to 20 feet width and 750 feet apparent length, with a paystreak on the north wall carrying chalcopyrite. Chalcopyrite also is noted about 10 miles west of the Davis mine, in Hampshire county. At Sheldonville, Norfolk county, a 94-foot shaft was sunk, circa 1901, on a quartz vein in granite, carrying values in gold, silver and copper.

MICHIGAN. The Lake Superior copper district of Michigan was the first American copper field of importance and now is one of the oldest of the leading copper producing districts of the world, as well as the third in size of output. It is the lowest in average grade of any successful copper mining district, and probably contains the most copper of any single field. While the cupriferous Keweenawan formation of Lake Superior outcrops to the eastward in the district of Algoma, Ontario, and to the westward traverses northern Wisconsin and is found in several of the eastern counties of Minnesota, the developed and productive mines lie wholly within the limits of Michigan.

Apparently the aboriginal inhabitants of what is now the United States were entirely unacquainted with bronze or brass, and made but slight use of copper at the time of the discovery of the new world by Columbus, though both copper and bronze were used extensively at that time in Mexico, where the superior Aztec civilization flourished. There are extensive remains, however, of mining done in the Lake Superior district by some race preceding the North American Indians. This people, whose civilization was of a higher order than that of the races succeeding, is known vaguely as the mound-builders. By this long-gone race, many of the Lake Superior copper beds were mined to shallow depth, for mass copper, and at perhaps a majority of the early-day mines, opened around the middle of the Nineteenth Century, there were pits and other evidences of prehistoric mining, to a greater or less extent. That they were good judges of mineral values has been proven by the making of good modern mines under many of these ancient pits. The Ojibways, who were found in possession of the southern shore of Lake Superior by the first white man penetrating to this inland sea, were but slightly acquainted with the practical use of copper, and had no legends regarding the mining done by their predecessors.

The existence of native copper on the southern shore of Lake Superior was first published to the world in a book by M. Lagarde, issued in Paris, in 1636, though it is probable that the existence of the metal was known only from the statements of the Indians to early French explorers on the

lower lakes. Truchement Bruslé is quoted in this book as having in his possession an ingot of copper secured from the Huron Indians. It is probable that Bruslé's ingot was merely a small mass of native copper.

The next notation of Lake Superior copper deposits is found in the Jesuit Relacions for 1659 and 1660. At that time the Ojibways had a few crude utensils made from copper, but the metals in their possession were mainly rough lumps, which the Jesuits said were worshipped, but which, in all likelihood, were merely venerated as unusual works of the Gitchee Manitou.

In the Jesuit Relacion for 1666-1667 is a chapter giving the journal of the exploration of Lake Superior by Father Claude Allouez, who seems to have been the first white man who, of a certainty, saw copper along the southern shore of the lake. In quick succession Lake Superior was visited by Fathers Marquette and Mesnard, and, as a result of their efforts, missions were established for the conversion of the natives. It was nearly another hundred years, however, before white men other than the Jesuit missionaries and French voyageurs and couriers du bois saw the shores of this remote and mysterious body of water.

In 1770 Capt. Jonathan Carver printed a book, in London, telling, among other things, of the native copper of Lake Superior, which, according to his account, could be had merely for the trouble of picking it up. This publication led to the formation of a mining company in London, and Alexander Henry, an adventurous Englishman, who was in turn hunter, trapper, explorer and miner, directed the operations of a party of English miners, who drove a long adit into a claybank beside the Ontonagon River, on property now owned by the Victoria mine, during the winter of 1771-1772. The spring rains caused the caving of the adit, and no further attempts at copper mining were made for seventy years.

When the treaty of Paris brought peace between the United States and Great Britain, Benjamin Franklin, who had heard of the mineral wealth of Lake Superior, deflected his pencil a trifle to the north, upon the crude map that was made the basis of delimitation, and thereby secured to the possession of the United States bodies of copper and iron that since have yielded those metals to the value of more than one thousand million dollars. Some effort was made by the American government, in 1798, to secure definite information regarding the Lake Superior copper deposits, and, in 1826, the Ojibways ceded their mineral rights to the United States government.

In 1830 the lake was first visited by Dr. Douglass Houghton, a young scientist combining rare technical skill with high courage and indomitable energy. Through his efforts was made the first survey of the Upper Peninsula of Michigan, comprising more than two-thirds of the southern shore of Lake Superior.

The first miners to reach the Lake Superior copper field were Jim Paull and Nick Miniclear, two backwoodsmen who came overland from southern Wisconsin in midwinter, suffering great hardships, and arriving on the shore of the great lake in March, 1843. Later in the same year a land office was opened by the Federal government at Copper Harbor, and a number of prospectors reached the field. The early mining locations were of immense area, and overlapped in a most haphazard and ridiculous

manner. Confusion grew until the government adopted the expedient of selling the mineral lands outright.

In 1844 other mineral seekers, mainly devoid of practical knowledge, arrived in the district, and the news of important discoveries became bruited about. In this year arrived the first Cornishmen, who were the first real miners to reach the district. The first actual mining of copper was done in 1844, the original product being a few tons of ore, called black oxide, but possibly chalcocite, taken from a fissure vein near Copper Harbor. This vein was abandoned quickly, but the same company opened a fissure vein carrying native copper, and begun the payment of dividends in 1849, since which year dividends have been paid annually by Lake Superior properties. Shortly after the opening of the Cliff mine, in Keweenaw county, the Minnesota mine was opened in Ontonagon county, at the other end of the district Cross-fissures only were worked at first, but these, while producing several highly profitable mines, have pinched out or lost their workable values at 2,500 feet or less in depth. The stratified beds, on which all the productive mines of the present day are developed, were neglected in the early years, and the Portage Lake district of Houghton county, now much the most important portion of the field, was neglected because of the few fissure veins found crossing the stratified beds. The first successful mining on cupriferous beds was done by the Quincy, which made a success of an amygdaloid lode, and gradually other amygdaloid beds were developed. The first successful mine to be opened on a conglomerate bed was the Calumet & Hecla, in 1866, which remains the largest and most profitable mine of the Lake Superior district, and has paid greater dividends than ever declared by any other mining company in the history of the world, these exceeding one hundred millions of dollars.

The first efforts at smelting were made in 1846, when a small furnace was built, by Prof. Jas. T. Hodge, on the Gratiot river, in Keweenaw county. This ran for two short campaigns only, as selected copper rock, assaying about 20 per cent. metal, gave smelter returns of only 3.5 per cent. copper, showing that nearly five-sixths of the metal was lost in the slags. A second furnace was built about 1847, by the Suffolk Mining company, seven miles southeast of Eagle River, but this was not a success. In 1849, a third furnace was built, on Isle Royale, but never put in commission. Until about 1850 all lake copper was smelted in Baltimore, but in that year J. G. Hussey & Co. built a copper smelter at Cleveland, and a smelter was built in Detroit in the same year, and shortly thereafter a successful local smelter was built at Hancock, in Houghton county. About 1863 a smelter was built at Ontonagon, and previous to 1867 a small and unsuccessful smelter was built at Lac La Belle, in Keweenaw county. The Calumet & Hecla smelter, at Hubbell, was built in 1886, the Dollar Bay works in 1888, the Quincy smelter in 1898 and the Michigan smelter in 1904.

The Keweenawan formation in Michigan may be divided into four parts, the first including Keweenaw Point at the eastward, the second, comprising the Portage Lake or central district, which includes the Calumet and South Range fields, and practically Houghton county, while the mines of Ontonagon county, and the trans-Ontonagon extension in Ontonagon and Gogebic counties comprise the third field. The fourth district is Isle Royale, nearly all of the island showing cupriferous beds, with many old and idle mines, mainly small.

The richest cross-veins of Keweenaw county were at the western end, the most notable being developed by the Cliff, Central and Phœnix mines, The fissure veins of Keweenaw county usually cross the stratified beds at approximately right angles. The most promising copper ore body of the Lake district was opened, circa 1845, on the northeastern side of Bohemian Mountain, and some ore therefrom was shipped to Swansea. The ore was mainly bornite, with some massive chalcopyrite, occurring in an 18-inch vein. There are narrow fissure veins of ore, mainly arsenical, in the Mohawk mine of Keweenaw county, and also in the South Range mines of Houghton county. Chalcopyrite has been found in the Huron shafts of the Isle Royale mine, at Houghton, and at Copper Harbor, in Keweenaw county, two shafts were sunk, to a depth of about 20 feet each, on what was believed to be melaconite, and about forty tons of ore were extracted therefrom, the deposit apparently being merely a pocket. The green stains of malachite are found in many cupriferous beds, in the partly decomposed portions at or near surface, but it is altogether probable that the carbonates were evolved from native copper by weathering

The Lake Superior copper formation, at least four hundred miles in extreme length, with one hundred and fifty miles in Michigan, on which more or less mining has been attempted, and about one hundred miles on which actual mining and development work is in progress, consists of a series of stratified beds, resulting from old lava flows. The Keweenawan series is a succession of extrusive lavas, more than two hundred in number, with intercalations of conglomerate, about thirty in number, and occasional intercalary sandstones. This formation has an average thickness of 25,000 to 30,000 feet in the main series, with a secondary series of conglomerates and sandstones outcropping in the Porcupine Mountains of Keweenaw county. Overlying the Keweenaw series, to the north and west, is a conformable sandstone, while to the east and south is an unconformable sandstone, equivalent in horizon to the Potsdam sandstones at the top of the Cambrian series. The Keweenawan series is of Algonkian age, and at the base of the Azoic or Archæan system, lying above the Huronian ferruginous series, with a fault against which the copper strata are tilted. The entire series of beds, including both traps and conglomerates, has been tilted to angles varying from 20° to 72° with the horizon. The overlying sandstone shows small specks of copper, not in workable quantities, while the underlying unconformable sandstone shows occasional impregnations of native copper, and apparent evidence of igneous metamorphism, near the point of contact.

The Keweenaw Peninsula rises to an extreme height of nearly 800 feet above the waters of Lake Superior, and it is supposed that it once formed the shore of a sea, over which poured vast floods of lava, gradual subsidence bringing the lava beds beneath the sea. The conglomerates were supposed to be of sedimentary origin, but this supposition calls for no less than thirty subsidences and emergences of the Keweenawan series, which seems a strain upon the imagination, especially as there are only occasional patches of sandstone in place of the considerable beds that might be looked for in connection with the conglomerates, though some of the conglomerates shade into sandstone in spots, and the upper series of the Keweenawan formation, not mined at present, shows thick beds of sand-

stone, some of which are cupriferous. It is probable that the conglomerates are partly tuffs of volcanic origin, though some undoubtedly are ancient sea-beds, formed by material laid down from rocks broken from adjacent shores. The Keweenawan series forms a syncline, of which the southern edge outcrops on the Keweenaw Peninsula, with dip to the north and northwest. The northern fold of the series outcrops on Isle Royale, with dip to the southeast. The axial line of the syncline runs somewhat north of east, but there is a marked divergence in the trend of the southern outcrops along the district where the principal mines are opened, the strike of the formation being approximately North thirty degrees East, in the Houghton county field, which produces nearly nine-tents of the total copper output of the Lake Superior district.

Toward the middle of the Keweenaw Peninsula the western sandstone is lost under the lake, and at Bete Gris Bay the eastern sandstone also plunges beneath the waters, leaving the Keweenawan series in sole possession of the eastern tip of the peninsula. The eroded edges of the solid rock formations of the Keweenaw Peninsula usually slope, under glacial drift, to the shore lines. The district was glaciated from northeast to southwest, at a comparatively recent age, when considerable drift was deposited in the lower portions of the surface, much of the district being covered with sand, gravel and boulders ranging from a few feet to three hundred feet in depth. As a result of glaciation and erosion the harder strata, notably the greenstone of Keweenaw county, outcrop prominently, and there are moraines at various points on the southern and eastern side of the peninsula, with quicksands that are difficult to sink through. In many places, especially at the crests and escarpments of crystalline igneous strata, the naked rock stands out strongly, but the lower portions are covered with drift. From Keweenaw Point toward the south and west there is a considerable thinning of the flows, with a corresponding thickening of the conglomerates. In addition to the main series of the Keweenawan belt, consisting principally of eruptive rocks, where is a second series, mainly of sedimentary rocks laid down at a later period, this second series being found in the Porcupine Mountains of Keweenaw county, and apparently resulting mainly from the breaking down of the eruptive rocks of the preceding formation, with redeposition of detrital material so secured, in the form of conglomerates and sandstones, mainly the latter. Rich cupriferous conglomerate float has been found from time to time in the Porcupine Mountains, but the bed has not been found in place. The Nonesuch shales and sandstones of the Porcupine belt contain very finely comminuted copper, with occasional silver.

The Keweenawan formation shows extensive fissuring, more notably in the middle and eastern portions of Keweenaw county, and there is considerable faulting. The longest throw that has been noted is 284 feet, on the east vein of the Central mine, in Keweenaw county, along the Kearsarge conglomerate, estimated as equivalent to a movement horizontally northward of more than two and one-half miles.

The dip of the strata of the Keweenawan series varies greatly from point to point along the strike, and in any given cross-section is sharpest along the eastern sandstone, and flattest along the western sandstone, an evidence of thrusting exerted from the direction of the eastern or Potsdam sandstone. The contact between the Keweenawan rocks and the eastern

sandstone shows the latter much tilted from the horizontal position occupied a short distance further east, the sandstone standing almost vertically at some points adjoining the eruptive rocks. At the Delaware mine, in Keweenaw county, the average dip of the Keweenawan beds is about 20°; at the Arnold mine, about 25°; at the conglomerate mine of the Calumet & Hecla, in northern Houghton county 37° 30′; at the Osceola mine, 41°; at the Franklin Junior mine, 47°; at the Quincy mine, 51°; at the Arcadian mine, 53°; at the old Atlantic mine, 54°; at the Isle Royale mine, 59° and at the Baltic mine, 72°.

The Keweenawan series, in Houghton and Keweenaw counties, may be divided lengthwise into three approximately equal parts. The flows of the upper third, lying to the north and west, have developed no paying mines. In the second series, including the beds approximately from the Atlantic to the Osceola amygdaloids, there are a number of successful mines, including the conglomerate mine of the Calumet & Hecla, while the lower third includes the Kearsarge and Baltic amygdaloids, which have shown the greatest persistence in retention of payable mineral values along their strikes, of any of the cupriferous beds yet opened in the Lake Superior district.

In the matter of arsenic, which is a deleterious element that is giving considerable trouble to many of the Lake mines, there are certain rules that seem to hold good in most cases, though with possible exceptions. The first of these rules is that arsenic increases with depth. In the cases where no arsenical cross-veins have been noted in the mines affected, it is possible that the increase of arsenic comes from the gangue. The second rule is that there seems, in the district from Portage Lake to the southern end of Keweenaw county, an increase in arsenic from south to north. The third rule, which is based on indubitable evidence, is that in any given cross-section the percentage of arsenic in the copper secured increases from the upper to the underlying flows, in a fairly steady ratio, the copper produced from the felsitic beds at the base of the series being notably arsenical.

A cross section of the Keweenawan series at any given point would show a large number of trap and conglomerate strata, varying greatly in thickness and of unusual persistence both as to length and depth. There necessarily must be an end to even the most extensive lava flow, and owing to inequalities existing on the land-surface and sea-bed over which these old flows were spread, any given stratum may be cut out temporarily, to reappear, at greater depth, or to either or both sides of the point of disappearance. The conglomerates afford the geological bases of measurement for the series, these being much more readily distinguishable than the trap beds, owing to cleaner walls and divergence in appearance from the surrounding and more numerous trap strata, and the correlation of cupriferous beds by means of measurements of the conglomerates has made great progress during the past decade. The conglomerates are composed of rounded pebbles of igneous rock, cemented mainly by reddish and yellowish particles of quartz-porphyry. The Calumet & Hecla conglomerate is felsitic. Of the conglomerate beds many carry copper in minute quantities, but only two have been mined seriously, these being the Calumet and Allouez conglomerates, of which the former has made the greatest mining success of the district, while the latter has been, on the whole, a failure.

The lava flows of the Keweenawan series have experienced long continued metamorphic action, producing amygdaloidal structures in the upper portions of the various beds, and these amygdaloidal portions of the trap flows, mainly melaphyrs, carry native copper as replacements of amygdules leached out, as irregular masses in beds or along contacts between different strata, and in fissure veins. Nearly all of the amygdaloids carry some copper, but the majority are too low in tenor to be workable.

The lava flows, as a rule, are composed of dark basaltic rock with the texture of diabase. Felsite rock are of rare occurrence, except in the lower part of the belt, the basal series being felsitic. The chief original minerals are felsite, augite, magnetite and olivine, the typical rock containing about 55 per cent. felsite and 30 per cent. augite, the balance being composed of magnetite, olivine and allied secondary minerals, the base of each flow being more augitic than the amygdaloidal upper portion. Of the basaltic rocks an average type would contain about 45 per cent. silica, 15 per cent. alumina, 13 per cent. iron oxide, up to 10 per cent. calcium, about 10 per cent. of combined sodium and magnesium, and one to two per cent. each of carbon dioxide, titanic oxide and water. According to Lane the formula of the average amydaloidal rock, deprived of its copper, might be written $CaO.MgO.Na_2O.FeO.(Fe,Al)_2O_3.4SiO_2$. Both amygdaloids and conglomerates carry much epidote, and other minerals, notably calcite, occur in connection with copper, calcite crystals that carry occluded crystallized native copper being fairly common, while some occurrences are among the largest and most perfect specimens of crystallization afforded by the mineral world. In the typical amygdaloids there are considerable quantities of prehnite, laumonite and other related silicates.

The genesis of the native copper deposits of Lake Superior remains obscure, and none of the theories provided by scientists is absolutely satisfactory, though synthetic laboratory experiments lend corroborative evidence to the theory more commonly accepted that the metal was deposited in native form from sea-water, where it had been held in solution. Dr. Koenig has found mine-waters depositing copper at the bottom of the Quincy mine, where the waters are strong brines, carrying considerable bromine. In the upper workings of the Lake Superior mines, to a depth of about 1,000 feet, the mine-waters are soft, or slightly hardened by sodium silicate. Below this depth the waters become briny with sodium chloride and calcium chloride, the latter increasing rapidly with depth, while below a half-mile the mine-waters contain a few grams of copper chloride per ton, and deposit copper therefrom as opportunity offers. Carbon dioxide is lacking almost entirely from the deep mine waters of the district. It seems probable that the native copper was deposited by sea-waters from sulphide solutions through chloride reactions. Such a reaction has been found in nature in New Zealand, where the sulphide ores of a mine abandoned for forty years were found partly transformed to native copper, by the action of the sea, which had broken into the workings. Another theory, quite commonly held, is that the metal was included originally in the magma of the basic lavas and was deposited in its present form by local concentration and metasomatism. Lava flows somewhat similar to those of the Keweenawan series carry native copper in Alaska, Newfoundland and elsewhere.

Metallic copper is found in all rocks of the Keweenawan series, including the superimposed western sandstone, and along the contact of the unconformable eastern sandstone as well, but excepting the sedimentary secondary series of the Keweenawan belt, in the Porcupine Mountains, none of the sandstones contain copper in workable quantities. The metal is found in both traps and conglomerates of the main series, the metal of the conglomerates occurring largely as cementing material. Copper occurs occasionally in the very dense trap rocks, but is found more commonly in the more open upper portions of the trap flows, where the amygdules have been leached out and replaced to greater or less extent by the native metal. It is obvious that the amygdaloidal portions of the flows were much more suitable for the physical reception of the metal than the extremely dense traps at the base of each flow.

In the amygdaloidal cupriferous beds the copper usually favors either the foot or hanging wall, but occasionally, in wide beds, occurs in streaks toward the centre, and usually is disseminated more or less irregularly through the entire width of the amygdaloid, but, with a tendency, perfectly natural in view of the physical structure of the amygdaloidal traps, to favor the hanging wall. Occasionally the mineralization is so strong that the dense basal portion of the superincumbent trap flow forming the hanging wall has been impregnated with fine copper for a few inches, or even for a number of feet, and is found workable for its metallic values.

The percentage of copper contained in the rock decreases in all mines opened to more than 4,000 feet in depth. As a rule, the amygdaloid mines usually show decreased values below a depth of about one-half mile. The payable cupriferous beds show copper courses in practically all instances, these being diagonal chutes of richly mineralized ground descending on the plane of the bed with a rake about midway between the strike and dip. Apparently the beds themselves will continue, in practically all cases, to much greater depth than mining is possible. The ultimate depth of mining cannot be foretold with any certainty, in view of the steady progress that is being made in knowledge, methods and equipments. The deepest mines of the world are in this district, the Tamarack having a vertical shaft of nearly one mile depth, while the Calumet & Hecla has a shaft sunk at an angle of 37° 30′ that is 8,100 feet in depth, with a winze of 190 feet sunk from the drift on the bottom level of this shaft. The great heat and briny waters found at the bottoms of the deep mines render work somewhat difficult, and these factors, combined with increased hoisting and mining costs, coincident with decreased copper contents, must, of necessity, eventually furnish a bottom for even the most ambitious of mines.

Considerable silver is carried in connection with copper in many of the Lake Superior mines. The mines of the Evergreen belt, in Ontonagon county, are the richest in silver, followed by the mines in the immediate vicinity of Portage Lake in Houghton county. The silver is mechanically admixed with the copper, but the two metals are not alloyed.

Various theories of cross-sectional mineralization in zones are held by students of this field, but none of them have been fully elaborated, and, while there seems some basis for such theories, there are conflicting features precluding their full acceptance at present.

Throughout the native copper district of Lake Superior there are puzzling magnetic earth currents, these being most marked on Isle Royale

all directions from Fredericktown, and believe this district to be one of the most promising copper fields between the Mississippi river and the Rocky Mountains.

MONTANA. This state has copper mines or attempts at mines in the counties of Beaverhead, Broadwater, Cascade, Deer Lodge, Flathead, Gallatin, Granite, Jefferson, Lewis & Clarke, Madison, Meagher, Missoula, Park, Powell, Ravalli, Silver Bow, Sweetgrass and Teton. The Butte camp in Silver Bow county is overwhelmingly preponderant in importance, being the largest and most important copper district of the world.

The mines of Jefferson county, which are found principally in the vicinity of Corbin, Clancy and Basin, seem next in promise to those of Silver Bow county, though production is not large as yet.

Missoula county, in the extreme western part of the state, carries the eastern extension of the Cœur d'Alene copper belt of Shoshone county, Idaho, with similar geological conditions, and at present, is a district of small development but considerable promise.

Meagher county has a number of small attempts at copper mines, including copper deposits in shale near White Sulphur Springs.

The Butte camp of Silver Bow county dates from 1863, when placer gold mining was begun. This was followed by silver mining in the following year, and copper was first discovered by crosscutting at depth from the shafts of the silver mines. The increasing percentage of copper in several of the silver mines in the western part of the camp led, in 1879, to the building of the first copper smelter by Senator W. A. Clark, the product being a highly argentiferous copper matte, in which the principal value was silver, the copper being used mainly for a carrier. In 1880 the Parrot and Boston & Colorado mines were making argentiferous copper matte, and in 1881 the great Anaconda mine was opened, treating ore at first that averaged about 30 oz. silver per short ton, the silver bullion being very base and containing about half copper. In 1882, at a depth of about 300 feet, the Anaconda found massive chalcocite in a crosscut, and from this find a considerable shipment of 50 per cent. copper ore was made to Swansea. From that date copper production increased rapidly, while the output of the silver mines has declined, though Butte became a much larger silver producer than ever before, owing to the metal secured as a by-product from the copper mines.

The Butte camp is known officially as the Summit Valley district, but this name is used rarely. The town is in the heart of the Rocky Mountains, and, in addition to being the largest copper camp, is the second largest mining camp of the world, ranking immediately after Johannesburg, while if white population only were counted, Butte probably would lead its South African competitor. In addition to the city of Butte, with nearly 75,000 people, that has grown up around the shafts, the copper industry of this camp supports the smelting towns of Great Falls and Anaconda, with nearly 20,000 people each.

The Butte camp is approximately a rectangle of four by seven miles, but the district as now proven is approximately two miles wide and three miles in length from east to west, the principal production coming from an area that is approximately one and one-half miles north and south by two miles east and west. The deepest shaft of the district is 2,800 feet,

showing good ore on the bottom level. Developments since the beginning of the century have increased considerably the area in which rich mines are opened, and, in addition, work of an exploratory nature has shown promising bodies of copper ore outside of the area formerly considered as including all of the possibly productive ground. The new developments have been mainly to the eastward.

The development of mines in this camp was seriously hampered for many years by the most extensive, bitter and protracted litigation to be found in any mining district, but, happily, this was settled in 1906, by a compromise in which both principals saved face, while benefiting by the cessation of litigation that was costing an average of nearly $2,000,000 yearly.

The Butte district shows an extensive area of igneous rocks of Tertiary age, with later intrusives. The oldest rock is a dark basic granite, or quartz-monzonite, known as the Butte granite, surrounded by altered limestone and other sedimentaries, and partly covered by andesite, the copper veins, so far as known, occurring exclusively in this rock. The Butte granite is cut by dykes of an intrusive, probably of the Eocene period, known as the Blue Bird granite, and aplite of later age. There is a still later intrusive of rhyolite-porphyry or quartz-porphyry, known locally as the Modoc porphyry. The older rocks are faulted by intrusive fracturing, producing fissures with a generally east and west trend. Those were faulted by prolonged volcanic activity, and are cut by intrusive rhyolite, conforming in trend with the dykes. The big butte north of the town, from which the city takes its name, is an eroded remnant of a small rhyolite volcano.

The mineralized veins in the northwestern portion of the camp, which were first to be mined, carry mainly silver and zinc values to the depths yet worked, but there are strong indications of increasing copper values at the bottoms of the deeper shafts. The most productive copper veins, which have a generally east and west trend, give poor surface showings, and, as a rule, are almost entirely barren to depths of 300 to 500 feet, and occasionally to a depth of 1,000 feet. The outcrops of these veins are decidedly unpromising in appearance, and gossans are almost entirely lacking. There are lower fissures, causing displacements of both the cupriferous and argentiferous veins, but these are poorly mineralized, as a rule. The silver veins show rather prominent gossans.

At depth there is a tendency of the wider copper veins to split into smaller parallel veins, separated by country rock that is considerably altered and somewhat mineralized. There also is an increase at depth in the number of smaller mineralized fissures, while some of the fault veins not mineralized in the upper workings carry good values at depth. The veins are very erratic in size, with many pinchings and bulgings from point to point, and with a general tendency toward increasing width at depth, this being followed by forking of the veins. The walls are poorly defined in many cases, and frequently are more of less mineralized. The heart of the Butte district forms almost a gigantic stockwerk.

No important copper district now worked shows such extensive alteration as is noted in the Butte camp. The process of secondary enrichment has been carried on so long, and so actively, that the gossans of the copper veins, undoubtedly large and prominent at one time, have

been lost almost entirely, through the combined effects of leaching an erosion. The leaching process has been so thorough that the principa copper veins show but slight traces of values for hundreds of feet fro surface, but, in compensation, the zone of secondary enrichment is th deepest found in any important copper camp, and massive chalcocite, large bodies, has been found at a depth of 2,400 feet below surface, wh the deepest shaft in the district shows secondary sulphides of good aver tenor on its bottom level. There is, however, a general tendency tow decreased values with depth, as in all other mining fields, but the gra decreased average tenor of the copper ores of Butte, as now smelted, i due partly to other factors than actual impoverishment of ore at dep the most important of these causes being the greater thoroughness w which mineral values are extracted, the scramming of ore left standi from early mining operations, and the vast improvement and cheapenin of metallurgical processes, by reason of which it is now possible to wor at a profit ores that were absolutely unpayable only a few years ago. The tenor of ore produced by the leading mines, except North Butte, shows a marked decline from the figures noted at the end of the Nineteenth Century, present extraction averaging as low as 2.5 to 3 per cent. copper from several of the more important mines.

The principal copper values of the Butte district are found in chalcocite and enargite, which furnish about 90 per cent. of the total production of the camp. Chalcocite occurs massive, in immense veins, also disseminated in granules. There is considerable bornite, which occurs extensively in the western mines, but is found sparingly in the eastern properties. The mines also produce considerable quantities of chalcopyrite and cupriferous pyrite, with more or less tetrahedrite and tennantite. The large amount of enargite smelted is responsible for the heavy arsenical fumes from the Washoe smelter, it being estimated that upwards of 30,000 tons of arsenic pass off yearly in the smelter fumes from the Washoe works.

The gangue of most of the ore bodies is granitic or silicious, consisting largely of altered country rock. The veins frequently show considerable fluccan, but, as a rule, partings are poorly defined, the ore fading into the country rock, which is impregnated to some distance on either side of the vein. The ores are highly silicious, averaging about 55 per cent. silica, 15 per cent. iron oxide and 10 to 15 per cent. sulphur, the high grade ores ranging 5 to 15 per cent. copper, with an average tenor of about 6 per cent., while 90 per cent. of the production of the district, excepting North Butte, is concentrating ore averaging 2 to 4 per cent. in copper tenor.

In addition to the ore bodies now worked there are immense deposits of ore of a grade still lower, and of a tenor too low to permit profitable working at present, though it is probable that eventually these ores will be extracted and treated at a profit.

While the Butte district has shown a marked tendency toward decreased values within the past decade, a similar tendency is noted in most other districts, and Butte, far from being a decadent camp, bids fair to hold its position at the head of the copper districts of the world for years to come.

NEVADA. This state has copper resources of prime importance

under development, and the Ely field promises to make a copper camp of the first magnitude, while developments elsewhere, notably in the Yerington district, are of promise. The state has copper mines, or attempts at mines, in the counties of Elko, Esmeralda, Eureka, Humboldt, Lander, Lincoln, Lyon, Nye, Storey, Washoe and White Pine. With the improvement in general mining conditions, brought about by the discovery of the gold bonanzas of Tonopah and Goldfield, and the improved facilities given by construction of new railroad lines, copper mining is making substantial progress.

In Esmeralda county the Sodaville and Mina copper districts are at the northern end of the Pilot Mountains, showing a contact zone of about twelve miles length, on the borders of a granite intrusive.

In Humboldt county there are promising copper deposits in the vicinity of Winnemucca, and in the Jackson Mountains, circa 60 miles north of Humboldt.

The Bunker Hill district, in the northwestern part of Lincoln county, shows nickel-copper ores, somewhat similar to those of Sudbury, with an average of about one-third ounce of platinum per ton of ore, in some cases.

The Yerington district, in Lyon county, circa 20 miles southeast of the Comstock lode, is in the Mason Valley Mountains, a small range of about 25 miles length and 5 miles width, with an extreme elevation of 6,500 feet. The core of this district is an intrusive granite, exposed by erosion in the higher peaks and deeper cañons, and covered by metamorphosed sedimentary strata on both slopes, with rhyolite flows along the eastern base. Copper ores occur in fractures and shear zones, and as bedded veins in dolomitic limestone, also as impregnations in limestone of Carboniferous age. The ores found in the dolomitic limestone are mainly oxidized, with quartz and calcite gangue, while the Carboniferous limestone shows mainly chalcopyrite, with a little chrysocolla and covellite in the oxidized zone, but the secondary sulphides, chalcocite and bornite, are found rarely. Owing to the heavy limestone gangue, carrying garnet and epidote, concentration is not effected readily, and the ores must be considered upon a smelting basis. Fortunately ore charges of about two-thirds sulphides and one-third oxides and carbonates are self-fluxing. Water supplies are available from the Walker river and from artesian wells.

In Nye county the Lone Mountain district is roughly eight miles wide by about twenty miles in length, showing at the northern end a monadnock lying about fourteen miles west of Tonopah. This district carries gold, silver, copper and lead ores.

In White Pine county the Robinson district, as it is called officially, but more commonly known as the Ely camp, is a low grade district of very unusual promise. This field, as now proven, is a belt of about one mile width by six miles length, having a generally easterly and westerly trend, transverse to the Egan Mountain range. There is an intrusive monzonite-porphyry of post-Carboniferous age cutting Carboniferous sedimentary strata, with intrusive monzonite dykes, copper deposits occurring in both the monzonite and the sedimentary strata adjoining. The principal ore body is that portion of the monzonite-porphyry lying under the zone of oxidation, and apparently is about 400 feet in thickness. According to

Prof. Lawson the workable ores are tertiary and not secondary, having resulted from the leaching of the former secondary ores of the oxidized zone. The porphyry mass shows large quartz blowouts that cover nearly one-third of the porphyritic area, these occurring mainly along the contact between the monzonite and limestone. The limestone on the northern flank of the porphyry shows small bodies of slightly argentiferous lead ore, and on the southern flank of the intrusive monzonite gold ores are found, in the sedimentary beds. The monzonite ores of the principal Ely mines sample 2.32 to 2.6 per cent. copper, 0.03 to 0.05 oz. silver and about 40 cents gold per short ton.

NEW HAMPSHIRE. Copper ores are found at a number of points in this state, especially in Grafton county, where more or less mining has been attempted. Occurrences of copper are noted at Bath, Franconia, Haverhill, Littleton, Lyme, Oxford, Warren and Woodsville in Grafton county, near Jackson and Madison in Carroll county, at Westmoreland, Cheshire county and at Croydon and Unity in Sullivan county.

NEW JERSEY. This state has copper deposits in the counties of Bergen, Hudson, Mercer, Middlesex, Passaic, Somerset, Sussex, Union and Warren, and more or less mining has been done in several of these counties, the principal operations having been near Arlington, Griggstown and Somerville. The Schuyler mine near Arlington, Hudson county, was the first New Jersey copper mine, and apparently was the second in the British colonies that later became the United States. This mine, only eight miles from New York city, was found in 1719 by a negro slave of the Schuyler family, which was made wealthy therefrom. The first steam engine in the United States was a pump of the Newcomen type, installed at this mine, and the first machine shop in the country was built in 1794 near Belleville, New Jersey, by the owners of this mine, and the first American copper smelter was built in connection with this mine. The property was a fairly steady producer until the American Revolutionary War, and thereafter was worked intermittently, being in the hands of an English company for some time after peace was restored between England and the United States. In the Arlington district there are cupriferous sandstones overlying trap beds, with impregnations of copper in shale adjoining the trap. Except in Warren county the New Jersey copper deposits occur in amygdaloidal traps, and in Triassic sandstone and shale adjoining traps.

In Somerset county, in eastern New Jersey, copper occurs in red beds of Triassic age, associated with intrusive diabase, showing oxidized ores above, with sulphides occurring at a depth of about 600 feet, while below a depth of 600 feet native copper and occasionally chalcocite in bunches are found, giving strength to the theory that the oxidized ores above are alteration products from native copper. The main ore bed varies from 3 to 15 feet in thickness, and has been traced five miles and worked more or less for that distance. At one mine there is an incline shaft of 2,360 feet in depth. Enough copper was secured from a mine near Bound Brook to cast a brass cannon for the American army, during the Revolutionary War.

In Pahaquarry township, on the Delaware Water Gap, in Warren county, the northeastern slope of the mountain shows red shales and Medina sandstones, some of the gray sandstones interbedded with red

shale carrying impregnations of chalcopyrite, cementing the grains to the extent of one to two per cent. copper. These beds aggregate fully 200 feet in thickness, and may become highly valuable at some future time, when ores of lower tenor than now worked will be available commercially.

NEW MEXICO. The first New Mexican copper mining in historic times apparently was done in the Santa Rita district, Grant county, about the beginning of the Nineteenth Century. Mining development, after the territory passed under American control, was hampered somewhat for many years by the old Spanish system of land titles, but this trouble has been remedied, in the main. New Mexico shows extensive areas of Permian red beds carrying finely disseminated copper ores in sandstones and shales and has copper ores in nearly all parts, copper occurrences being noted in the counties of Chaves, Colfax, Donna Ana, Grant, Lincoln, Mora, Otero, Rio Arriba, Sandoval, San Miguel, Santa Fé, Sierra, Socorro, Taos, Union and Valencia.

Donna Anna county has promising copper deposits in the Oro Grande Mountains, about 15 miles northeast of Las Cruces, and in the Organ district has copper mines on contact deposits between metamorphosed limestone and igneous intrusives.

In Otero county there are mines of copper in the Jarilla Mountains, with considerable development under way in the vicinity of Orogrande.

Rio Arriba county has extensive copper deposits in the Bromide district. These apparently are of low average tenor, though of considerable size, but have been developed only slightly.

In Sandoval county chalcocite is noted, in Triassic sandstones, in the Nacamiento district.

Socorro county is large and has a number of copper districts of various degrees of promise, including the Cooney, Kelly, Magdalena and other districts in the Mogollon Mountains, also copper fields in the Socorro and Oscura Mountains. The Cooney district, on the western side of the Mogollon Mountains, in the southwestern corner of the county, shows dacite flows, cut by rhyolite dykes, copper ores occurring in brecciated fissures near contacts, and as true fissures that carry argentiferous secondary sulphides and gold in the oxidized zone.

Taos county has pre-Cambrian deposits of sulphide copper ores associated with sphalerite.

Grant county is the source of the principal copper production of New Mexico, and has two important fields, and several others of promise. Among the new fields the Hachita district shows promising properties.

The Lordsburg district of Grant county is about eight by eighteen miles in extreme area, and is located in the Pyramid Mountains. The development of this field dates from 1870, and its history is filled with ups and downs. The Pyramid range apparently dates from about the close of the Tertiary age, showing fissure veins and shear zones carrying all of the common oxides and carbonates, secondary sulphides and chalcopyrite, with considerable galena, occasional sphalerite and cerussite, and a variety of silver ores.

The Santa Rita district of Grant county was the scene of the first copper mining in this territory. This district shows an underlying core of igneous rock, with an overlying bed of quartzite impregnated with oxidized ores and occasional *native copper, some sulphide* ores occurring

in the underlying porphyry. Although mining has been done in this district for about a century, the workings were merely superficial until a deep shaft was begun in 1906.

The Burro Mountain district of Grant county is the most important in the territory. This field lies about fifteen miles south of Silver City, at the base of the Burro Mountains, and mining dates from 1879. Several small copper smelters were erected in the ninth decade of the Nineteenth Century, but the most important development dates from about 1903. The Burro Mountains are a short isolated range of only about five miles extreme width by ten miles length, showing narrow veins of cupriferous pyrite in porphyry, and associated deposits of disseminated chalcocite, with some ore bodies of unusually large size carrying sulphide ores of low average tenor, frequently zinciferous and refractory. The mineral values occur principally in chalcocite and cupriferous pyrite, with small quantities of gold and silver. The sulphides average 3.5 to 4 per cent. in copper tenor, and there are some oxidized ores, but the zone of oxidation is quite shallow.

NEW YORK. The only copper mine ever opened in the state of New York was at Canton, St. Lawrence county, but this never became an important producer. There are occurrences of ore, however, at numerous other points in the state. Chalcopyrite is found in the Ancram and Beckee lead mines in Columbia county; at Crown Point in Essex county; at Alexandria and Antwerp in Jefferson county; at Salisbury in Herkimer county; at Ladentown, Rockland county, where malachite and cuprite occur in the seams in the trap; at Ellenville and the Red Bridge lead mines in Ulster county; cuprite, azurite, malachite and chalcopyrite occur in the vicinity of Conklingville, Saratoga County; at Chester, Warren county, and at East Chester and Ossining in Westchester county.

NORTH CAROLINA. This state has copper in the counties of Alexander, Alleghany, Ashe, Buncombe, Cabarrus, Caldwell, Catawba, Chatham, Clay, Davidson, Gaston, Granville, Guilford, Jackson, Lexington, Lincoln, Madison, Mecklenburg, Mitchell, Montgomery, Moore, Person, Randolph, Rockingham, Rowan, Stanley, Swain, Transylvania, Wautauga, Wilkes and Yadkin. As a rule the ores occur in mountainous districts near the contacts of basic rocks altered to hornblende-schists, which apparently were the source of the metal, and which still contain small quantities of chalcopyrite and pyrite. The ores of North Carolina are mainly sulphides, but native copper and practically all of the commercial ores of copper, as well as many rare minerals, have been found. Copper mining was followed to a small extent previous to the American Civil War, mainly in Ashe and adjoining counties. The state is notably rich in available water powers, which should prove valuable in the development of its mineral resources.

The Virgilina district lies along the border of Virginia and North Carolina, including the counties of Person and Granville in the latter state. The length of this belt is about twenty five miles, with a width of about three miles. The Virgilina district is in the sub-Piedmont division of the Appalachian belt, and contains a number of small mines of some promise.

In the same division of the Appalachian belt, but some distance to

the south, is found the Gold Hill district of Rowan county. This field was worked originally for gold, yielding about $3,500,000 from 1842 to 1893, inclusive, but the mines eventually were closed down, because of change of values at depth from gold to copper. The district is about one mile wide and twenty miles long, lying on a plateau of the Piedmont Mountains. The predominant copper ore is chalcopyrite, with gangue of quarts and decomposed schist. The outcrops of prominent ore bodies carry one to twenty per cent. copper, and some ores can be concentrated ten into one. The average sulphide ore of this district carries 2 to 4 oz. silver and 50 cents to $2 gold per short ton. The ore occurs in fissure veins, the secondary zone carrying considerable native copper and rich oxides and carbonates. The deepest workings are nearly 1,000 feet.

In Webster county, in the Cullowhee district, there is one producer and several developing properties of promise. This field shows lenticular bodies of chalcopyrite with quartz and corundum gangue, and prominent gossan cappings in a fracture plane following a basic band in schist.

NORTH DAKOTA. Copper was reported December, 1906, as occurring in this state, but a satisfactory verification of the statement has not been secured.

OHIO. Small masses of native copper, brought from Lake Superior by glacial action, are found occasionally in drift in this state, and native copper ingots and ornaments are taken from mounds built by a prehistoric race, but, so far as known, no copper has been found in place.

OKLAHOMA. Copper ore has been found in small quantities at several points in the state of Oklahoma, notably in the mountains of Woods and Woodward counties, where auriferous copper ores have been found, but no mines have been developed.

OREGON. Copper ores are found in this state in the counties of Baker, Douglas, Grant, Jackson, Josephine, Lynn, Marion, Umatilla, Union and Wallowa. Oregon enjoyed a small share of the California copper boom of 1860-1868, when there was considerable activity in southwestern Oregon, notably in Josephine county, where a smelter, one of the earliest on the Pacific coast, was built for treating oxidized copper ores. Josephine county carries the northern extension of the Coast Range copper belt found in Siskiyou and Del Norte counties of California. This belt, about 25 miles wide and approximately 50 miles long, shows large copper veins, usually carrying fair gold values near surface. The ore is mainly chalcopyrite, with occasional bornite, disseminated in pyrite and pyrrhotite. The district has one small but modern smelter, which can work only four to five months yearly, because of the heavy snows and rains that render the mountain roads impassable except in the summer.

Baker county, in eastern Oregon, has a number of developing copper properties of considerable promise. This county carries the western extension of the Seven Devils district of Idaho, along the Snake River. The copper deposits occur mainly in basaltic flows, interbedded with sedimentary rocks of Triassic age, showing fine grains of chalcocite and bornite, with occasional chalcopyrite, in lavas and tuffs, the mineralization apparently following the jointing planes.

The copper production of Oregon is small, but promises to increase.

PENNSYLVANIA. This state has copper ores, and in several cases old copper mines, in the counties of Adams, Berks, Bucks, Chester, Co-

lumbia, Lancaster, Lebanon, Montgomery and Philadelphia. The l copper producer of Pennsylvania was the Gap mine in Lancaster cou which was opened as a copper mine, late in the Eighteenth Century, and such was a failure, but was reopened as a nickel mine, circa 1850, was a successful producer of that metal, with a small incidental ou of copper, until 1893, when it was closed by the competition of the ri nickel-copper mines of the Sudbury district of Ontario. The old mi Cornwall, in Lebanon county, show native copper, cuprite, azurite, m chite, chalcopyrite, chrysocolla and brochantite. In Montgomery cou the Perkiomen mine shows fully as long a list of copper minerals. I Gettysburg, in Adams county, native copper and cuprite are noted, native copper, cuprite, melaconite, malachite, chalcopyrite, auricha and chryscolla occur in Jones's mine, near Morgantown, and elsewhe Bucks county. Oxide, carbonate, sulphide and silicate ores of co have been found in the Frankford stone quarries, in the city of Ph adelphia.

RHODE ISLAND. There are no mines of copper in this state, bu chalcopyrite occurs near Portsmouth, Newport county, and occurren of azurite, malachite, bornite and chalcopyrite are reported from oth points, though apparently found nowhere in commercial quantities.

SOUTH CAROLINA. Chalcopyrite is noted sparingly at the Pa Forest gold mines of Union county, but no copper deposits of promi have been found in the state.

SOUTH DAKOTA. Copper ores are noted in the counties of Custe Lawrence and Pennington, all in the Black Hills, and a little co mining has been done in these counties. Copper ores are used to a limi extent for fluxing refractory gold ores at some of the local smelters. Ge logically, the copper measures of the Black Hills are comparable wi those of the Ducktown district of Tennessee.

TENNESSEE. This state has important active copper mines in Pol county, small and idle mines in Sullivan county, and occurrences of co per ore are reported from Lawrence county and from Jellico Plains, Mo roe county.

The discovery of copper in the Ducktown district of Polk coun was made in 1843, by a gold hunter, who mistook crystals of cuprite fo gold. As early as 1854 there were two small matting furnaces in co mission, and 14 mines were worked, most of the ore being hauled by wagon 40 miles to a railroad, and shipped to Swansea for reduction. Th district prospered until 1863, when work was suspended, owing to th American Civil War, and the mine remained idle until 1866, when wor was resumed and continued until 1878, after which the entire district remained idle until 1891, when a British company begun work on a moder scale, and has scored a marked success. The Ducktown district lies in the extreme southeastern corner of Tennessee and extends into the adjoining states of Georgia and Alabama. The Ducktown basin is an eroded plateau enclosed on three sides by mountains rising 500 to 2,500 feet above the general level of the country, the basin having an average elevation of about 1,500 feet above sea level. The country rock of the Ducktown plateau consists of foliated mica-schist, with intercalary gneiss, and the ore occurs in a fault-zone in rocks of lower Cambrian age. The mine

show a heavy gossan of fair grade hematite, which is shipped extensively to iron furnaces. The oxidized zone is comparatively shallow, and has been worked out in the active mines, leaving only chalcopyrite, associated with pyrrhotite in a gangue of quartz, epidote and other metamorphic minerals. The sulphide ores average about 2 per cent. in copper tenor, and are neither auriferous nor argentiferous, occurring as great lenses in metamorphic schist, sometimes with sharply defined walls and again grading into the country rock.

TEXAS. Copper ores in this state are noted in the counties of Anderson, Archer, Baylor, Burnet, Clay, El Paso, Hardeman, Haskell, Knox, Lincoln, Llano, Mason, Montague, Presidio, Stonewall, Taylor, Wichita, Wilbarger and Wise. A little native copper is found in Burnet and Llano counties, with chalcopyrite in both counties and argentiferous tetrahedrite in the latter. Along the Brazos river there are Permian red beds showing carbonate and silicate ores in sandstone. There have been occasional sporadic attempts at development of copper mines, but as yet nothing serious has been accomplished, the ores as a rule being low grade carbonates, sulphides and silicates, distributed in beds of Permian age.

UTAH. This state, while now ranking fourth in point of production among American commonwealths, is scarcely second to any in promise, and possesses in one of its camps the largest bodies of ore of any metal known anywhere upon the globe. The copper production is increasing rapidly, and, in 1906, the copper output of Utah was about as great as the production of either Michigan or Montana in 1887, and about as large as the output of Arizona in 1897. The state has copper mines, or attempts at mines, in the counties of Beaver, Box Elder, Davis, Emery, Grand, Iron, Juab, Morgan, Piute, San Juan, Salt Lake, Summit, Tooele, Uintah, Utah, Wasatch, Washington and Weber.

In Box Elder county, near the Nevada line, there are promising copper deposits in limestone, showing good gossans above, and, as a rule, having heavy fluccans along either or both walls.

The first mining in Utah was done in Beaver county, just before 1860. The principal copper developments in this county are in the Cactus district, and at Milford. The richness of the Beaver county ores has been exaggerated, for stock-selling purposes, but one of the mines, under careful management, has reached the point of paying dividends, and it is probable that Beaver county will be given more serious attempts at mining in the future.

Juab county, in the centeral western portion of the state, has a number of old and large producers of silver and lead, and with increasing depth there is an increase in copper values, with considerable gold. The Tintic district, of which Eureka is the principal town, shows Carboniferous limestones, with intrusive quartzite on the west and rhyolite on the east, with ore occurring as contact deposits in both the sedimentary and igneous rocks, the ores being almost exclusively sulphide and carrying good values in lead, zinc, copper, silver and gold.

Piute county has been almost exclusively a gold and silver mining field, but shows considerable copper.

In San Juan county there is a copper field showing sedimentary rocks of Carboniferous age, these including limestone, shale and quartzite,

which have been intruded and fissured, with extensive metamorphism. Quartzite is the predominate rock form, with intercalary limestone below and Carboniferous shales, sandstones and limestones in the upper part. The lower limestones, of dolomitic nature, carry copper ores, as do the Carboniferous shales of the upper portions. There are many intrusive dykes and sills of monzonite-porphyry. Ore occurs in the intrusive zone in limestone, or at the point of contact in deposits roughly parallel with the bedding planes of the country rocks, which are mineralized in lenticular chutes dipping with the bedding planes, and with moderate pitch.

Tooele county is primarily a gold district, with considerable silver production, and small outputs of both lead and copper, but has copper deposits of promise.

Summit county was originally a silver-lead district, and these metals still predominate in output, but considerable sulphide copper ore is found in the lower workings of the argentiferous lead mines.

Salt Lake county contains three important mining fields, of which one is a copper camp of the first magnitude. The Little Cottonwood district, with Alta as its center, shows good values in lead, copper and silver, and has several good mines. The Big Cottonwood district, with Brighton as its center, shows mainly silver and lead values, but copper indications are promising.

The Bingham camp, known officially as the West Mountain district, in Salt Lake county, already an important camp, is certain to become one of the greatest copper mining fields of the globe. It lies about 20 miles southwest of Salt Lake City, on the eastern slope of the Oquirrh Mountains, with an area of about fifteen square miles. Water is scarce, being supplied chiefly from the mine workings. This is an old camp, worked originally for silver-lead values, and dates from the opening of the Old Jordan mine in 1863. The extraction of gold from the heavy gossans was begun in 1880, but did not prove profitable. The first copper mining, begun in 1896, was done on fissure veins carrying disseminated copper sulphides averaging 3.5 per cent. copper, 2.5 oz. silver and 10 cents to $1 gold per short ton, with irregular but sometimes important lead values, and with occasional sphalerite. Several large and profitable mines have been opened on the sulphide veins which occur in dolomitic limestones near igneous intrusives, the lenticular ore bodes lying roughly parallel with the beds and the country rock, some of these lenses being of great size, ranging up to 200 feet in thickness and several hundred feet in length and depth, and carrying excellent average values.

While the mines opened on the contact deposits of sulphide ore have rendered Bingham an important producer of copper, recent developments on the monzonite ore bodies are of far greater importance. While a limited amount of mining of monzonite ores has been done in Graham county, Arizona, it may be said that Bingham is the first camp in the world to turn country rock into ore upon any large scale. The monzonite ore bodies of Bingham are of the very greatest commercial importance and contain hundreds of millions of tons of ore. The ore concentrates excellently, though there is a loss of nearly 25 per cent. at present, mainly due to sliming, but this probably can be reduced to 20 per cent., and possibly to 15 per cent, eventually, by various minor improvements in milling. The ore of

the monzonite-porphyry is chalcopyrite, quite evenly disseminated in small grains throughout the porphyritic mass, with occasional veinlets carrying high-grade chalcocite and bornite. The porphyritic ores range from 0.72 per cent. to 1.75 per cent. in copper tenor, and, at the principal property, the average of six thousand assays gave 1.98 per cent. copper, 0.15 oz. silver and 0.016 oz. gold per ton. Owing to the system of mining, by which the monzonite mountains are quarried off by steam shovels, this copper field should give the lowest average mining cost of any in the world, with milling costs nearly as cheap as in the Lake Superior district, and eventually the present smelting costs should be reduced materially.

VERMONT. In this state there are copper mines in the counties of Lamoille and Orange, the latter being the more important, and copper ores are noted also in the counties of Franklin, Madison and Rutland. Copper mining was an industry of some importance in Vermont previous to the opening of the Lake Superior district, and the largest mine of the state was a famous producer for many years. The Vermont ore is chiefly chalcopyrite, and is noted at Brandon and Cuttingville in Rutland county, at Bridgewater in Madison county, at various points in Franklin and Lamoille counties, and at South Strafford, Copperfield, Vershire, Corinth and elsewhere in Orange county.

There are three principal copper districts in Orange county, the northern being at Corinth, where the Union mine is the most important property. The middle district is at Copperfield, where the Ely mines, opened in 1821, were the largest in the state, and the southern district is at South Strafford, where the Elizabeth mine has been a considerable producer. The ore is mainly chalcopyrite disseminated in pyrite and pyrrhotite, with a small amount of other gangue. The Elizabeth mine is the oldest in the state, having been opened in 1793 and long worked for cupriferous pyrrhotite. The Orange county deposits considerably resemble those of the Capelton district in Quebec, to the north, and are somewhat similar to those of the Ducktown district of Tennessee. The country rock is mainly contorted metamorphic sericite schist, surrounded by sedimentary beds of Paleozoic age, with pegmatite dykes. The Ely ore body is 20 to 30 feet in thickness, up to 150 feet in width, and has been mined to a depth of 3,600 feet. According to Weed the mineralization was pneumatolytic, due to emanations from granitic magma.

VIRGINIA. The existence of copper in this state has been known from early colonial days, and copper ores are noted in the counties of Albemarle, Buckingham, Carroll, Charlotte, Culpepper, Fauquier, Floyd, Fluvanna, Franklin, Grayson, Greene, Halifax, Loudoun, Louisa, Madison, Montgomery, Nelson, Orange, Page, Rappahannock, Rockingham and Stafford. In Louisa county the copper ore bodies have strong hematite gossans, which were mined for iron ore at one time. In this county cupriferous pyrite mines are worked, but no attempt is made to save the copper values, except by the leaching of mine waters, from which a little cement copper is secured.

The copper fields of Virginia may be divided into four principal groups, known as the Virgilina, Blue Ridge, Gossan Lead and Loudoun-Culpepper districts. In the Piedmont region there also are copper deposits in Albemarle, Buckingham and Charlotte counties.

The Virgilina district lies in Halifax county, Virginia and in Granville and Person counties, North Carolina. The field is about three miles in width by twenty-five miles in length, and in Virginia runs from the state line to the Hyco River, about 8 miles north. The ore is mainly chalcocite, with occasional bornite, having a gangue of quartz and talcose altered country rock, the ore averaging about 3 per cent. copper, but with chutes of high grade ore running 5 to 25 per cent. in tenor. Selected ores, as shipped average 6 to 10 oz. silver and 75 cents gold per ton. The ores which are highly silicious and require concentration, occur in lenticular chutes of varying sizes, from 6 inches to 20 feet in width, and with an extreme length of several hundred feet, lying in fissure veins cutting schistose rocks altered from andesite and similar volcanic rocks. The average copper tenor of the ores of the district is said to be about 2 per cent.

The Blue Ridge district runs along the mountains in the counties of Warren, Fauquier, Rappahannock, Madison, Page and Greene. This district shows pre-Cambrian basaltic flows, capped by sedimentary beds and intruded by granitic rocks, later faulted and subjected to regional metamorphism. The gossans are not prominent and the copper occurs mainly native and as cuprite, with small quantities of carbonates and occasional bornite and chalcopyrite. This district shows mainly gash-veins, with promising surface ores which do not hold to depth.

The Gossan Lead of Grayson, Floyd and Carroll counties, in southwestern Virginia, shortly above the North Carolina line, is traceable for upwards of ten miles in a fault fracture between schists and slates of Cambrian age and metamorphosed schistose diorite. This district has been worked extensively for iron ore, from its limonite gossans, and produced a little copper in the decade previous to the American Civil War, from chalcocite disseminated in pyrrhotite, but the average copper contents are estimated as slightly under one per cent.

The fourth district includes Loudoun and Culpepper counties, where copper ores are noted at various points, and where there have been some desultory attempts at mining at various times.

WASHINGTON. This state has a number of copper deposits of considerable promise, and bids fair to become an important producer eventually. Copper ores are noted, and there are mines, or attempts at mines, in the counties of Chelan, Clarke, Cowlitz, Ferry, King, Kittitas, Lewis, Lincoln, Okanogan, Pierce, Skagit, Skamania, Snohomish, Stevens and Whatcom.

In Chelan county there are large bodies of ore of low average grade, and the district is regarded as promising.

In Ferry county there are copper ores in the vicinity of Republic, and most of the mines in that camp carry cupriferous values to a greater or less extent.

In King county the Skykomish or Foss River district shows promising occurrences of ore, mainly chalcopyrite, with good outcrops.

In Kittitas county the Cle Elum district shows a cupriferous belt, nearly a mile in width by several miles in length, carrying copper ores of good average tenor that show strong outcrops.

Okanogan county, near the British Columbia boundary line, shows

numerous bodies of copper ore, mainly of low grade, but of considerable size, and the field is one that may develop important low grade mines in time.

In Pierce county native copper occurs near Eatonville, and various copper ores are found elsewhere in the county.

The Mount St. Helens district lies mainly in Skamania county, with portions in Cowlitz and Lewis counties. There are several promising mines under development in this field.

In Snohomish county the Darrington district, in the Cascade Mountains, has a number of developing mines, opened on a wide ore zone carrying paystreaks of massive bornite and chalcopyrite The Index district of Snohomish county shows a number of properties, on which more or less work has been done, but has suffered severely from wildcat promotions. The veins generally are narrow, and values irregular, occurring in concretions and kidneys of bornite, with small granules of bornite disseminated in a granitic gangue. For concentration the ore must be crushed to about sixty mesh, and slimes so badly that on an average less than half the copper values have been recovered.

In Stevens county the Chewelah district shows chalcopyrite, both massive and disseminated in pyrrhotite, in schist, near a granite contact. This district has been a small producer of copper for many years.

WISCONSIN. Copper ores are noted in this state in the counties of Ashland, Burnett, Chippewa, Crawford, Douglas, Grant, Iowa, Lafayette, Polk and Sauk.

The northern fold of the Keweenawan trap formation extends across the Lake Superior shore of northern Wisconsin, from Hurley to the Minnesota line, carrying more or less native copper in the amygdaloidal portions of various trap beds. The Keweenawan series is fully described in the article on Michigan. Some remains of prehistoric mining have been discovered east of the Fond du Lac mine, near the Brule river, and in the vicinity of the Percival mine, in Douglas county. The first attempt at copper mining, in historical times, was made in Douglas county, in 1845, by the North American Fur Company, which opened a shaft on a lean vein of tetrahedrite. Further mining attempts in this district were made in 1855, 1862, 1873 and 1898. Work was resumed in 1907 on a property on the Minong range, which is on the southern fold of the Keweenawan syncline, in the southern part of Douglas county.

In Crawford county an attempt was made at copper mining just previous to 1860, in the vicinity of Prairie du Chien. Copper ores are noted in the lead and zinc districts of southwestern Wisconsin at Shullsburg, Lafayette county, and at Mineral Point, Iowa county, where some crude attempts at copper mining have been made. Chalcopyrite and malachite have been found in Sauk county, and auriferous and argentiferous copper ore was found in 1902 in a diamond drill hole bored north of Osceola, Polk county. Copper ores are found south of Boscobel, Grant county, and chalcopyrite of good grade occurs near Mellen, Ashland county, where some attempts have been made at mining.

WYOMING. This state has copper mines or attempts at mines in the counties of Albany, Big Horn, Carbon, Converse, Frémont, Laramie. Natrona, Sheridan and Weston. The state has copper fields of consider-

able promise, but production has been small, owing to lack of transportation facilities in the principal districts.

The Grand Encampment copper district is of immense size, having an estimated area of 2,500 miles, lying in the southern half of Carbon county and the southwestern quarter of Albany county, and being divided into nearly equal parts by the North Platte river. The Sierra Madre Mountains lie to the west and the Medicine Bow range to the east. Gold prospecting was begun in 1898, but was not especially successful, and was followed a year or so later by copper prospecting. The district has been a producer since 1900, hand-selected ores shipped for treatment ranging 30 to 49 per cent. in copper tenor in carload lots, the higher grade ores carrying $8 to $10 gold and silver per ton. The general formation of the Sierra Madre Mountains is an irregular core of red granite, with superimposed Algonkian mica-hornblende schists. Associated with the schist, and conformable in strike and dip, are huge ledges of limestone and altered schist, known locally as lime dykes, being composed mainly of limestone and silica. There are extensive evidences of alteration and replacement in the granite, diorite and schists. The principal ore bodies occur on the contacts between the schists and adjacent rocks, notably quartzite. The gossans usually are of soft spongy limonite, with some hematite and a little quartz. The veins range from mere stringers to 20 feet in width, and the zone of oxidation, as determined, is from 35 to 100 feet in depth, being succeeded by bornite and massive chalcopyrite, the oxidized zone showing mainly azurite and malachite, with a little native copper. The Medicine Bow range shows a core of gray and red granite, flanked irregularly by schist and gneiss, with dykes similar to those of the Sierra Madres. The Rambler mine, in the Medicine Bows, was opened in 1900, for gold, abandoned as worthless, and relocated for copper. This mine is notable for its large quantities of covellite, and for carrying platinum, palladium, osmium and iridium, this being the first known occurrence of platinum in connection with copper.

In Albany county, in addition to a portion of the Grand Encampment district, there are copper mines in the Spring Hill and War Bonnet divisons of the North Laramie Peak district.

The Laramie Hills district runs along the southern boundary of the state, from Laramie through Albany and Converse counties, to Casper, Natrona county. This range shows a granite core, with generally north and south trend, flanked by schists and various sedimentary beds. Copper occurs native, in red altered granite, at Sherman Hill, and as sulphide ores at Hecla, Slate Creek, Cooney Hill and to the northward of Laramie Peak. Laramie county includes the Hartville uplift, in east central Wyoming, showing a considerable geological resemblance to the Black Hills of South Dakota. Copper ores are found throughout the entire uplift in fissure veins and lenses, usually pinching out at slight depth, and also as blanket veins. Some copper mining was done in this vicinity as early as 1881, when 75 men were employed at the Sunrise mine, but the industry was not successful, owing to lack of rail transportation.

CHAPTER XV.

Copper Deposits of Canada and Newfoundland.

In this chapter the copper deposits of Canada are treated in detail by provinces and territories, and, for geological convenience, Newfoundland is added, although Newfoundland is not a part of the Dominion of Canada, being the oldest colony of the British crown. Because there seems no other place for it, the few lines referring to the discovery of copper in Greenland are added to this chapter, though Greenland is an appanage of the Danish crown.

Although copper has been mined for many years in the eastern provinces of the Dominion of Canada, and the mines of Georgian Bay, in Western Ontario, are of practically the same age as the oldest of the Lake Superior properties in Michigan, the Canadian copper industry did not come to importance until the exploitation of the great nickel-copper deposits of the Sudbury district, beginning with about 1886. Ten years later the production of the Trail district in British Columbia became important, and was followed by far greater developments in the Boundary district of the same province, this field now ranking among the really important copper districts of the world. Despite its considerable present development, the copper industry of Canada must be rated as merely in its infancy, and the dominion must be included in any list of the principal copper producing countries of the present or future.

British Columbia produces more than three-fourths of the Canadian copper output, and Ontario furnishes nearly all the balance of the production, but there are small mines in most of the other provinces, and the territory of Yukon is a potential producer of importance.

BRITISH COLUMBIA. This Canadian province is a kingdom in both area and resources and its developed wealth in timber, minerals, arable lands and fisheries is trivial, compared with its possibilities. The first mining was for gold, in placer washings, shortly after the middle of the Nineteenth Century, after which the mining industry languished, until the completion of the Canadian Pacific railroad, when quartz mining was begun, in a small way, first for gold and silver, and later for lead. It was found, about 1896, that the mines of the Trail district carried considerable copper values, and the copper industry of the province dates from that discovery. In the last years of the century the first copper mines were opened in the Boundary district, and these have become of great importance. Most of the gold and silver mines of British Columbia carry more or less lead and copper, highly useful as fluxing agents, while the copper ores almost invariably have appreciable values in gold and silver, this comity of the metals aiding greatly in the development of the various mining fields of the province, most of which are low in grade, though with large ore bodies.

In 1906 the Boundary district made 75 per cent. of the total copper production of British Columbia, followed with 12.5 per cent. from the

mines of the Pacific coast, and 11.5 per cent. from the Rossland mines of the Trail district. Nearly all of the other mining districts of British Columbia have copper ores, with small mines, or attempts at mines, but in 1906, the production of all the other districts combined was 1.5 per cent. of the total output of the province. With better transportation facilities, some of the other districts, now negligible as producers of copper, should become of importance.

The copper smelting industry of the province is well developed, and British Columbia has some of the largest, most modern and best managed copper smelters now in existence, and the Granby mine, of the Boundary district, holds the world's record for low smelting costs.

The Boundary district, lying along the northern border of the state of Washington, includes the Kettle River, Grand Forks and Osoyoos mining divisions, which are contiguous. The mountains are not especially rugged, and as a rule the western and southern slopes are open. The formation includes somewhat altered sedimentary rocks, mainly limestones, with granite, greenstone and other eruptives, the ores of the district occurring mainly in altered limestone near the contacts with igneous intrusives. The ore bodies are almost exclusively disseminated sulphides, very low in grade, but of immense size, slightly auriferous and argentiferous, and self-fluxing, requiring only small charges of coke for reduction. The Boundary district is an important copper field, and must continue to increase in production for many years to come. This district is comparable with the Lake Superior copper field, not only in the low grade of its average ores, but also in the enormous size and certainty of its ore deposits, and the magnitude of the investments and equipments required for profitable copper production. These heavy investments afford assurance of permanent operation, and heavy production, regardless of fluctuations in the price of the metal.

The copper deposits of the Pacific coast include numerous mines on the various islands scattered from Puget Sound to the Alaskan boundary, and also on the mainland. Most of these mines are on Vancouver Island, where copper ores are found along the western side. Ore occurs mainly as replacements in marble and greenstone, along and near the contacts with dykes of igneous rock. The ore bodies are very irregular, and carry magnetite and garnet gangue, with segregations of chalcopyrite and local enrichments of bornite. On Texada Island the nature and occurrence of ore bodies are practically similar to those on Vancouver Island, and, in the main, the coast deposits are of this same class.

The Trail district, of which Rossland is the center, shows an area of eruptive rocks, mainly diorite, cut by many porphyritic dykes of one to eighty feet width, having a mainly north and south strike. Veins are shear-zone fissures, ores consisting of country rock more or less replaced by or impregnated with cupriferous pyrrhotite, the metallic values being mainly in gold but including considerable copper, and a small amount of silver.

The Yale district includes the Similkameen division, with exposures of copper ore, mainly refractory, at many points. Development is slight but the district is of considerable promise. The Aspen Grove field in Similkameen division shows eruptive rocks in parallel flows, ore occu

mainly in a red breccia that carries native copper and chalcocite, intermixed. There also are promising showings of ore at various points in the Keremos section of the Similkameen, the best of these being in the vicinity of Olalla and Princeton.

FRANKLIN. Indications of copper are reported from several points along the eastern side of Baffins Land.

KEEWATIN. In the southern portion of this district, north of the Albany River, native copper is shown in conglomerate, and there are indications of copper on the western side of Hudson Bay. The Copper Mine River, flowing into a bay of the Arctic Ocean, must have been named for some real or fancied exposure of the metal. The district of Keewatin is wild, and but little known, though it gives indications of mineral wealth at various points.

LABRADOR. There are fairly good indications of copper in the Chibougamou district, and also on the East Main River. Labrador is in the peculiar situation of being a district wthout a regular local government, the management of its affairs being divided between the Canadian province of Quebec, which looks after the bulk of the peninsula, and the crown colony of Newfoundland which administers the narrow strip along the eastern shore that is known as Ungava.

MACKENZIE. An immense outcrop of high grade sulphide ore is reported to exist near the mouth of the Mackenzie River on the Arctic Ocean, some distance north of the Arctic Circle, but it is possible that the value and size of this deposit have been exaggerated, as the information comes from whalers, devoid of geological knowledge or practical mining experience.

MANITOBA. Along the eastern boundary of this province, near Lake of the Woods, is a small area of mineral land, and a vein of 18 to 20 inches width, reported to occur between granite and trap and to be traceable for a half mile, showing a cupriferous, nickeliferous and slightly auriferous pyrrhotite, has been prospected slightly at Ingolf station, near the Ontario border.

NEW BRUNSWICK. Copper ores are found in the counties of Carleton, Charlotte, Gloucester, St. John and Westmoreland, and native copper is found in red sandstones of Carboniferous age. These sandstones range nearly to conglomerates, and apparently carbonaceous material has been replaced, to a large extent, by copper sulphides. Attempts have been made at mining both ores and native copper.

NOVA SCOTIA. This province has copper mines in the counties of Cape Breton, Cumberland, Inverness and Pictou. Native copper occurs in the counties of Annapolis, Cumberland, Digby and Kings, and, in addition to these counties, copper ores are found in the counties of Antigonish, Colchester and Sydney. The ores are mainly sulphide, and nickeliferous copper ore is reported from Cape Breton county. At Brier Island, Digby county, native copper occurs as nodules in an amygdaloidal trap, similar to occurrences in the Keweenawan formation of Lake Superior. The deposits of Inverness county are of auriferous and argentiferous chalcopyrite, and those of Cape Breton county are of a similar ore, having a silicious

gangue, and occurring in veins traversing diorite and felsite. The more important mining developments are in Cumberland, Inverness and Cape Breton counties, the Coxheath mines of the latter county having been the principal producers in the past.

ONTARIO. Copper was discovered on the northern shore of Lake Huron as early as 1770, but the first real mining was begun at the Bruce Mines, on the northern shore of Georgian Bay, in 1846, immediately after the opening of the first Lake Superior native copper mines in Michigan. Copper is found native at numerous points, and in the Sudbury district occurs as nickel-copper sulphides, but the deposits mainly are iron-copper sulphides. As a rule, the oxide and carbonate ores of the alteration zone are missing in Ontario, the iron sulphides, mainly chalcopyrite, reaching to surface with slight traces of change, though small quantities of bornite are noted at times.

Ontario is a large province, and shows a great diversity of geological and topographical conditions, its frontier marching with New York in the east and Minnesota on the west. The province has copper mines in the counties of Frontenac and Hastings and in the districts of Muskoka or Parry Sound, Nipissing, Algoma, Thunder Bay and Rainy River, and, in addition, has copper ore in Lancaster and Lanark counties, and elsewhere.

The Muskoka district lies along Parry Sound, on the eastern shore of Georgian Bay. The surface of the country is glaciated, showing mainly rock exposures. The prevailing rock-forms of the district are gneisses and schists, the formation showing much flexure and faulting, with numerous small quartz veins and frequent pegmatite dykes of large size and great persistence. The topography is rough, and much of the rock is utterly devoid of vegetation or covering of any sort, the bald knobs alternating with marshes and swales in the lower ground. The mineralized zone is apparently about a quarter of a mile in width, with a generally northeast and southwest strike, and has been prospected for about twelve miles in length. Ores occur as extended and approximately parallel series of lenses, with a general trend in line with the mineral belt, practically along the fault zone, lenses varying from 5 to 40 feet in width, as a rule, though occasionally showing much greater width, and usually carrying a limonite gossan. The ore is mainly chalcopyrite disseminated in pyrite, showing occasional chalcocite and bornite, and carrying $3 to $10 gold per ton. Sphalerite is associated with copper, as a rule, and some of the beds are nickeliferous, ranging as high as 2.5 per cent in nickel tenor.

The Sudbury district, discovered 1882, where mining was begun in 1886, is an oval of about 40 miles length by 20 miles width and is considered locally as two ranges, each crescents with ends joined. The principal developments are on the south or old range, running from Sudbury to Carson. The interior of this oval shows a trough of rocks of Cambrian and Silurian ages, consisting of slates, sandstones and volcanic tuffs, flanked on the outside by granite. The ores occur as irregular chutes, in mammoth lenses varying greatly in metallic values, but with an average of 2.5 per cent. to 5 per cent. nickel, and carrying, as a rule, about one-half as much copper as nickel.

Copper developments in the Nipissing district have been overshadowed

by the sensational discoveries of native silver in the Cobalt field, but there are bodies of copper ore in this district that seem worthy of exploitation.

The district of Algoma is very extensive, and shows copper at many points. Principal development in the past has been in the Bruce Mines district, on the northern shore of Georgian Bay, where the ore is chalcopyrite, with quartz gangue, in strong fissure veins. Between Sault Ste. Marie and Sudbury there are several developing mines of considerable promise, in the Massey Station district, and good sulphide ores have been found in the Goulas Bay region, circa 30 miles north of Sault Ste. Marie. The Keweenawan formation of Michigan is found on Michipicoten Island, and also on the mainland east of the island, at Mamainse Point, about 50 miles north of the Soo, but exploratory work has not as yet shown workable values in the native copper deposits. Michipicoten Island also carries various sulphide and arsenide ores of copper.

In the Thunder Bay district, on the northern shore of Lake Superior, native copper has been found on Battle Island, east of Thunder Bay, on St. Ignace Island, in Nepigon Bay, at Black Bay, on Shebandowan Lake, at Pointe-aux-Mines, and elsewhere. Chalcocite is noted on Spar Island, and chalcocite and malachite are found on Silver Islet, this tiny island having been the location of the first great native silver mine of the world, which was fully as rich as any of the present-day bonanzas of Cobalt. Chalcopyrite also occurs at Neebing and elsewhere.

In the Rainy River district sulphide ores of copper have been found at various points, but the mining in that district has been mainly for gold, in the numerous fissure veins with quartz gangue that traverse granite, and which have an unfortunate habit of going wrong at a depth of 400 to 500 feet.

There are strong evidences of copper in the wild and little known district between Sault Ste. Marie and James Bay, and with the completion of a projected railroad, certain to come sooner or later, this district may prove an important producer of both copper and iron, and very likely of silver as well.

QUEBEC. Copper ores have been found in the counties of Arthabaska, Bagot, Beauce, Browne, Dorchester, Drummond, Levis, Lotbiniere, Megantic, Missisquoi, Richmond, Shefford, Sherbrooke and Wolfe, also on the northern shore of the Gulf of St. Lawrence in the district of Saguenay, and promising specimens of ore have been secured from the Lake St. John district, near Labrador.

The principal copper deposits of Quebec, judged from development in the past, lie in three zones, shortly north of the Vermont border, in Sherbrooke and adjoining counties. These belts average about two miles width, and are about 25 miles apart. The eastern belt has been the principal producer, from mines in the vicinity of Capelton. The western belt is about 60 miles east of Montreal, showing ore bodies in limestone, near igneous intrusives. The ores of the Capelton district are mainly chalcopyrite, or cupriferous pyrite and pyrrhotite. The pyrite of this district occurs in lenses, following cleavage planes, varying from 12 inches to 30 feet in thickness, and up to 100 feet in length. The principal mines have been opened in limestone associated with slate, in contacts with

diorite and serpentine. The cupriferous pyrites are of good sulphur tenor and while the Capelton mines carry only 2 to 4 per cent. copper, and to 4 ounces silver per ton, the sulphur values render these low-grade ore profitable, when worked with skill and prudence.

YUKON. The principal copper deposit, and the only developed copper mines of Yukon, are found in the vicinity of White Horse, near the Alaskan border. The White Horse district, at the head of navigation on the Lewes River, is connected with Skagway, Alaska, by the White Pass & Yukon railroad, 110 miles in length, which has such tremendous grades that five 110-ton locomotives are required to take a train over the summit. Copper was discovered in this district in 1898, and a number of small but rich mines have been developed, these being much hampered in production by exceedingly high freight rates, and lack of local smelters or local fuel available for smelting purposes.

The White Horse copper belt is 15 to 20 miles in length, with a generally north and south trend, west of and nearly parallel with the Lewes River, with a width, as developed, of one-half mile to nearly 3 miles. The belt shows copper deposits along the contact of limestone and granite, the contact deposits connecting with fissure veins traversing granite. The developed mines are 4 to 10 miles southwest of White Horse, and the district has been prospected for about 20 miles, with assessment work done on about 200 claims. The zone of secondary enrichment shows occasional carbonates, but principal ores are sulphide, formerly reported as mainly chalcopyrite with occasional chalcocite and bornite, but the ores now developed are mainly bornite. It is probable, however, that pyritic ores will succeed at slightly greater depth. The enriched sulphides carry fair values in both gold and silver, and the ores shipped have been of very high tenor. Exploratory work is hampered by a glacial moraine, which leaves only occasional exposures of ledge-rock. This district is of some present importance, and of much greater promise for the future.

NEWFOUNDLAND. The first copper mines of importance were opened in the Tilt Cove district in 1862, and remain considerable producers. There are deposits of chalcopyrite and cupriferous pyrite at many different points on the island, with occurrences of native copper in Placentia Bay, and elsewhere. The developed mines carry cupriferous iron pyrites, in which the sulphur values are an important factor. The island produced about 1,500,000 tons of cupriferous pyrites to the end of the Nineteenth Century, and apparently has far greater available resources for the future.

The Newfoundland deposits occur mainly in serpentine rocks and chloritic slates lying parallel to the serpentine in rocks of lower Silurian age. The principal cupriferous districts are on Notre Dame Bay, in the northeastern portion of the island, this including the Tilt Cove and Betts Cove fields, at Bay of Islands, in the western portion, and at Lady Pond and Birchy Cove. On Oderin Island, in Placentia Bay, in the southeastern portion of the island, native copper occurs in stratified archaic rocks, and one mass of copper weighing 55 pounds has been taken from a melephyr, in strata of a geological horizon corresponding to that of the Keweenawan formation of Lake Superior.

e Tilt Cove district, on Notre Dame Bay, in the northeastern por- the island, has been traced for about 40 miles, and the Tilt Cove are the only steady copper producers on the island. The district 4 main series of lenses, carrying pyrite in which is disseminated pyrite having an average tenor of about 4 per cent. copper, 50 per ulphur and $1.50 gold per long ton. The ore is bunchy in occurrence, e beds ranging from 4 to 10 feet in average thickness, but being broken and disturbed, while the veins frequently become barren, and rite is found in frequent connection with chalcopyrite.

REENLAND. An exploratory expedition, sent to Greenland in 1906, . Bernberg, a public-spirited merchant of Copenhagen, reports the ery of large deposits of copper ore at Alanjarssnak, on the western of the island.

CHAPTER XVI.

Copper Deposits of Mexico.

The Republic of Mexico has made relatively greater progress in copper production, since the beginning of the Twentieth Century, than any other country, and in actual increase of output stands second only to the United States. There is every reason to predict a large and fairly steady growth in Mexican copper ouput, as all of the essentials of a large and profitable production are found in more than one state of the Republic, such essentials being enormous deposits of ore of medium to high grade, transportation facilities, that in many cases are excellent, and which are being improved by extensive railroad construction, and settled political conditions. Occasionally complaints are made by foreigners, operating mines in Mexico, of unjust treatment by the authorities, but, as a rule, these complaints fall into two classes, the first being due to neglect to comply with the just but stringent Mexican laws regarding titles and methods of keeping accounts, while the second, having a foundation of fact, relates to the petty exactions of petty officials. In cases where the operators of mines have experienced arbitrary or unjust treatment from local officials, complaints to the governors of the states, or to the president of the Republic, have resulted, almost invariably, in the speedy correction of any injustice.

Previous to the Spanish conquest the Anahuac races had acquired considerable mining experience and metallurgical skill. The work of extracting metallic values done by the aborigines of Mexico deserves to be called real mining, as the antiguas of date previous to the conquest show shafts and tunnels of considerable extent. The metals found by Cortez in more or less general use, and for sale in the great market place of Tenochtitlán, included gold, silver, copper, tin and lead. Copper was employed freely in the mechanical arts, the metal being used mainly in the form of bronze, through alloying copper with tin, and was hardened by hammering. The best tools of the natives, made previous to the Spanish conquest, assay about 94 per cent. copper and 6 per cent. tin. Not only did the Aztecs utilize the metals for industrial purposes, but they had, apparently independent of old-world influences, developed a system of metallic currency, with gold in quills and copper coins in the shape of the Gothic letter T.

In 1895 the Mexican copper output was only 11,620 long tons, and ten years later exceeded 55,000 long tons, a growth of practically five hundred per centum in a single decade, being much the largest proportional increase made by any country, and the largest actual increase made by any nation except the United States. At the end of July, 1906, there were mines as follows in Mexico: copper, 956; iron and copper, 209; copper and lead, 25; silver and copper, 773; silver, copper and lead, 310; gold, silver and copper, 1,314, a total of 3,587 copper mines and mines with cupriferous values, as compared with 2,931 different cupriferous mines in the preceding year. In July, 1907, there were upwards of 1,000 copper mines alone,

and nearly or quite 4,000 mines in which copper values were of appreciable importance. These figures are not for single pertenencias, as is the case in Chile, but are for individual properties, ranging in size from a single hectare to thousands of hectares in the case of the Greene-Cananea and other large mines.

The smelting industry of Mexico is highly developed and is increasing rapidly in importance. The production of copper in a given field depends not only upon the richness and extent of its ores, and the experience and energy of its miners, but also is dependent to a very large extent upon the items of transportation and smelting. The transportation facilities of Mexico are excellent, for so rugged a country, and are being improved steadily, by the construction of new railroads of prime importance. The republic now possesses some of the largest and most modern smelters of copper and lead to be found anywhere upon the globe, and further enterprises of great importance are projected. It is doubtful if any country of equal extent anywhere upon the earth's surface possesses mineral values equal to those of Mexico.

Mexico has copper mines in the states of Aguascalientes, Chihuahua, Coahuila, Durango, Guanajuato, Guerrero, Hidalgo, Jalisco, Mexico, Michoacán, Neuvo León, Oaxaca, Puebla, Queretaro, San Luis Potosí, Sinaloa, Sonora, Tabasco, Tamaulipas, Zacatecas, and in the territories of Baja California and Tepic. In point of production of copper, Sonora easily leads, with Lower California second, but there are copper developments of prime importance in a number of other states, notably in Chihuahua, Coahuila, Guerrero, Jalisco, Michoacán and Puebla.

Copper in almost every known form is found in some part of the republic, the cupriferous measures being very extensive and including a great variety of types. Argentiferous copper ores are found frequently near the crystalline slates of the Azoic group, a typical example occurring in the district south of Puebla. Copper accompanied by hematite is noted in cretaceous beds of Mesozoic age, while in the Cenozoic group copper is found in regular veins in hornblendic andesite of the Pliocene system, also in the stratified sedimentary beds of the upper Miocene and lower Pliocene, as at the Boleo mine in Baja California. Copper deposits occur frequently in acid Tertiary rocks. The Sierra Madres are highly mineralized, not only as to the main range, but also, as a rule, in their foothills and outlying spurs. In northern Mexico there seems a preponderance of silver-lead deposits on the eastern slope, and of copper and gold values on the western slope of the cordillera. The principal mining portion of Mexico extends, unbroken, for a distance of fully 1,500 miles, with an average width of 250 miles, from the American border on the north into the state of Oaxaca in the south and the possibilities of Mexican mining developments in the future are past human computation.

AGUASCALIENTES. In July, 1907, this state had 49 registered copper mines, in addition to numerous other properties carrying copper as other than the principal metal. The principal copper developments are in the dioritic rocks of the Tepezalá district, where the ore is mainly chalcopyrite, with silicious gangue. The copper ores of the Pánuco district occur mainly in pegmatite dykes, as chalcopyrite.

BAJA CALIFORNIA. Though known to the early Spanish conquistadors, little mining was done in Lower California until the middle of the Nineteenth Century, and the first copper mining of real importance dates from the discovery of the Boleo mines, in 1868, and the beginning of their exploitation, in 1871. The Boleo mines occur in a district of approximately three miles width by seven miles length, on a plateau lying parallel with and near the coast. The development of this district has been in the hands of a single company, and it is probable that other deposits of value remain for later development. The Boleo mines are opened on beds occurring in a formation of Tertiary sandstones, conglomerates and tuffs. The cupriferous beds, three in number, of large area, lie upon conglomerates of varying horizons, and are overlaid by argillaceous tuffs, all traversed by fissures. In the upper bed, above the water level, the values are in disseminated oridized ores, such as cuprite, melaconite, azurite, malachite, atacamite, crednerite and chrysocolla, all in quantities of commercial importance. In the second ore bed there are peculiar globular concretions of oxide and carbonate ores, called boleos, whence the name of the mine. The third bed, in addition to the oxide, carbonate and silicate ores, carries the secondary sulphides chalcocite, covellite and bornite. The ores are disseminated in irregular masses, veinlets and concretions, in a clayey tuff, with a marked tendency toward concentration upon the underlying conglomerates, where the ores occur compact in layers of six to ten inches.

In July, 1907, Baja California had 65 registered copper mines, and in addition to the Boleo mines of Santa Rosalia, there are promising beds of copper in the municipalities of La Paz, Mulegé, Comondu, Todos Santos and San Antonio, and in Baja California Norte there are rich copper ores, apparently of considerable extent, near San Fernando and about 70 miles south of San Quintin, with promising ore bodies in the Santa Catarina division.

CHIAPAS. The only developed copper property of importance in this state is the Santa Fé mine, though extensive remains of prehistoric operations are shown, these including surprisingly long tunnels, showing that the ancient miners were both persistent and skillful.

The Santa Fé mine, near the Tabasco line, is a contact deposit of most unusual type, the ore outcropping in strata of wollastonite resting on slate, with underlying massive igneous rocks, as contact deposits in wollastonite and between wollastonite and the igneous intrusives. The ore body is of great size, carrying bornite, chalcopyrite, bournonite and tetrahedrite, with chimneys of oxidized ores, all of the ores being argentiferous and associated with free gold, the ore having a garnet gangue. The ore values average 3 to 4 per cent. copper, 6 to 8 ounces silver and $6 to $30 gold per ton.

There also are auriferous copper mines, slightly developed, in the Pichucalco district.

CHIHUAHUA. This state is mainly a producer of silver and lead, being one of the greatest lead mining fields of the globe. Copper frequently is found associated with silver-lead ores, and there are some deposits in which copper is the predominent factor of value. Copper production is

increasing steadily and gives promise of much future importance. Copper is produced on a commercial scale, not only at a number of distinctively copper mines, but also from cupriferous sulphide ores in silver-lead deposits. There are copper mines in the districts of Bravos, Guerrero, Jiménez, Ocampo, and Parral, and in addition to these, copper deposits are known in the districts of Arteaga, Galeana, Iturbide and Matamoros.

COAHUILA. In July, 1907, the state of Coahuila had five copper mines, and a considerable number of other mines carrying copper values. The most important cupriferous district, judged by present developments, lies near Jimulco, a short distance south of Torreón, in which copper ores of excellent average tenor occur in limestone strata in a district showing no igneous outcrops.

COLIMA. In July, 1907, the state of Colima had twelve registered copper mines, all with small development, and oxide and carbonate ores of high grade have been found at numerous points in this state.

DURANGO. There were fifty-one copper mines officially registered in Durango in July, 1907. The principal cupriferous developments are in the Velardeña district, where highly important mines have been developed on copper-lead ores. There are small copper mines in other fields, with numerous occurrences of copper ore throughout the state.

GUANAJUATO. The state of Guanajuato is one of the most famous mining districts of the world, and its silver mines are credited with a production of about $600,000,000, measured by gold values. The silver mining industry of Guanajuato is being rejuvenated by American enterprise and capital, and the future of the district is brighter than for many years. One of the old mines of the city shows considerable copper ore, apparently in workable quantities, but this never has been utilized, because silver was the metal desired. In July, 1907, the state had four registered copper mines.

GUERRERO. The state of Guerrero had 44 copper mines and a number of other mines carrying copper values, in July, 1907. These mines are located in the districts of Ajuchitlán, Aldama, Bravos, Minas, Tavares and Taxco.

The most important copper mines are La Dicha group, in the districts of Bravos and Tavares, south of the Balsas river, on the Pacific coast of the southern Sierra Madre range, and about forty miles from the port of Acapulco, where extensive developments are under way. The ore exposures of this group are more or less continuous for four to five miles, showing mainly chalcopyrite, associated with pyrrhotite, in micaceous metamorphic schist with quartzite bands, the deposits carrying a thin but rich bed of secondary sulphides immediately above the pyritic ores. The average values of the pyritic ores probably are 3 to 4 per cent. There are copper deposits of promise adjacent to La Dicha group, along the Balsas river.

In the Ajuchitlán district, fissure veins with quartz gangue, in granite, carry prominent gossans, showing considerable chrysocolla in the oxidized zone, in addition to the usual oxide and carbonate ores. Auriferous copper veins occur in aplite and Tertiary diorite, in the Minas district.

HIDALGO. There were five registered copper mines in the state of Hildago in July, 1907, the principal copper district being at Zimapán, where considerable work is under way.

JALISCO. The state of Jalisco leads all the others of Mexico in the number of copper mines, official figures showing no less than 302 copper properties in the state in July, 1907. Most of these mines, however, are small, though there are many of considerable promise, and a good start has been made at mining and smelting under modern conditions. Jalisco was the seat of a primitive copper mining, smelting and manufacturing industry of considerable importance, under the Aztec races, previous to the Spanish conquest. The principal cupriferous fields of the state include the districts of Ameca, Autlán, Ayutla and Cacoma, in all of which active copper developments are under way. Auriferous copper veins occur in Tertiary diorite in both the Ameca and Cacoma districts. The ores are mainly oxides and carbonates, with a little chalcopyrite, all strongly argentiferous, and at Autlán in addition to large quantities of malachite, sulphide ores are much in evidence.

MEXICO. The state of México had three copper mines in July, 1907, and shows native copper and tetrahedrite in beds on the border, near Tejupilco, Jalisco.

MICHOACÁN. According to official records there were 95 copper mines in the state of Michoacán in July, 1907. This state is mountainous, and with rather indifferent transportation facilities, these drawbacks retarding development. One present-day property, the Inguarán, was worked extensively in the days of the aborigines, and other copper mines were wrought by the Aztecs.

There are deposits of copper ore of more or less importance in the districts of Angangueo, Ario, Churumuco, Huacana, Huetamo, Oroalo, Patzcuaro and Tacambaro, the principal copper mines as now exploited being in the district of Augangueo and in the Inguarán division of the Tacambaro district.

In the Inguarán field ore deposits are found in micaceous quartzose diorite country rock and granite in several stages of alteration, with a capping of silicious limestone of 200 to 300 feet in thickness. The deposits show oxidized ores above, but the principal values are in disseminated chalcopyrite, with a little bornite, both carrying fair silver values and a little gold, with a gangue of granite-porphyry, the ores being disseminated through the country rock.

The Churumuco district shows high grade ores in fissures in dioritic porphyry. In the Oroalo district veins occur in feldspar-porphyry, similar to those of Real del Monte in the state of Hildago.

NUEVO LEÓN. According to the government records there were three copper mines in Nuevo León in July, 1907, but none of extensive development or of unusual promise. There are copper ores at a number of points in the state.

OAXACA. According to government records, there were only four copper mines in the state of Oaxaca in July, 1907, but there were many mines in which there were considerable copper values. There are copper mines in the Ocotlán and Ejutla districts, south of the city of Oaxaca,

and there are copper ores also in the districts of Miahuatlán, Villa Juárez and elsewhere.

PUEBLA. There were five registered copper mines in this state in July, 1907, including the Teziutlán mines, which are much the most important copper producers in southern Mexico. The ores occur in irregular deposits as an intimate mixture of chalcopyrite, galena and sphalerite, in highly metamorphosed calcareous Cambrian slates. Impregnations of copper in andesite are noted near Colucán, and copper ore exists at various other points.

SAN LUIS POTOSÍ. There were fourteen registered copper mines in this state in July, 1907. In the Matehuala district, which is the most important producer of metal, the copper ores are mainly sulphides, with garnetiferous gangue, occurring as contact deposits between limestone and porphyritic rocks. There are cupriferous deposits of promise in the districts of Catorce and Salinas, and copper ores exist at a considerable number at other points.

SINALOA. There are copper ores in nearly every district in the state of Sinoloa and the number of registered copper mines in July, 1907, was 25. The northern part of this state is a continuation of the Sonoran plateau, but owing to indifferent transportation facilities, no important mines of copper have been developed, though there are several properties of considerable promise. With the completion of two new railroad lines now under way, traversing this state, copper mining should become an important and profitable industry. In olden times considerable high-grade copper ore, mainly argentiferous, was smelted in crude adobe furnaces, near the mines.

SONORA. The state of Sonora, one of the richest in the Republic of Mexico, is of immense size, being nearly twice the area of the state of New York, or as large as Michigan and Indiana combined, and is one of the richest mineral fields in the world. It is much the most important copper producing state of Mexico, and one of the leading copper fields of the globe, with unusually brilliant prospects for the future. According to the government records there were no less than 234 copper mines in the state in July, 1907, in addition to mines carrying mixed metallic values. Considerable copper was produced in adobe smelters, during the years of Spanish domination, and under the republic, previous to the modernization of the copper industry begun in the closing years of the Nineteenth Century. Humboldt predicted, nearly one hundred years ago, that the mineral wealth of the world would be developed in Sonora, which then consisted of the present states of Sonora and Sinaloa in the Republic of Mexico, and the territory of Arizona in the United States. This prediction is being borne out to the letter, as there is no richer mineral field, of equal area, upon the globe.

Sonora, lying on the western slope of the Sierra Madres, is far richer in copper and gold than is Chihuahua on the eastern slope, where the values are mainly in silver and lead. The principal Sonoran copper deposits are of the Carboniferous system of the Paleozoic group. Copper development, which requires the best of transportation facilities, has been hampered by lack of railroads, but a considerable amount of railroad build-

ing is now under way. The frequent outbreaks of the Yaqui Indians also have caused much trouble in several of the mining fields. There are copper mines in the districts of Alamos, Altar, Arizpe, Hermosillo, Magdalena, Moctezuma, Sahuaripa and Ures.

The Alamos district is essentially a silver field, but contains much copper, this metal being an important by-product from the Quintera silver mines. The Piedras Verdes copper deposit is one of considerable promise, and there is little doubt that copper mines of importance will be opened, in time, in this district.

The Altar district has mines of gold, silver and copper, but developments in the copper line have been on a rather limited scale in the past, though the district has properties of promise.

The Arizpe district is the scene of the most extensive copper mining development in Mexico, and is the site of one of the greatest copper industries of the globe, in the municipality of Ronquillo, generally known as the Cananea field. The Cananea mines were worked as early as the Eighteenth Century, by the Casa Gua, of Chihuahua, later by Don José Perez, and eventually, in the latter half of the Nineteenth Century, by Governor Pesqueira, passing, in 1899, to the predecessors of the the present owners. The Cananea Mountains are an isolated range of about 25 miles length, lying in the free zone of northern Mexico, only a few miles south of the Arizona border, the range being of the short, isolated, variety typical of the Sonoran plateau in both Sonora and Arizona, and to the southeast is the Sierra Manzanal, almost a continuation of the Sierre de Cananea. The Cananea range of mountains consists of shattered and altered Paleozoic limestones, with intrusive masses of diorite and rhyolite, flanked by bedded tuffs. The mountain range has a northwesterly and southeasterly strike, the highest point being Elenita Peak, 7,600 feet above sea-level, and there is a zone of fissuring along the axis of the belt, ore bodies occurring as concentrations and replacements in either limestone or porphyry, the former being of Paleozoic age and the porphyries being largely rhyolitic. The district gives every indication of great volcanic activity at some remote date, followed by heavy erosion. As a rule the gossans are not heavy, much of what appears to be gossan at a short distance proving, on closer inspection, merely stained and weathered conglomerate. There are numerous ore bodies occurring as contacts between limestone and the igneous eruptives, largely as patches surrounded by crystallized rocks. The ores are of a great variety, ranging from native copper, in masses up to a hundredweight or even greater, through the rich oxidized ores and secondary sulphides, down to disseminated chalcopyrite. The ore of the Capote zone is almost exclusively pyrite coated with very thin films of chalcocite, usually with a porphyritic silicious gangue. The Capote ore body occurs in shattered quartzite, the ore being soft and containing sericite, causing trouble in concentration. The mines show a considerable variety of forms of occurrence, including contact metamorphic deposits, impregnated sedimentary rocks and fissure veins.

The principal developments in the Cananea field are in the southeastern half of the range, which is separated into two nearly equal portions by Puertecitos Pass. There is reason to believe, however, that ore deposits of value exist in the northern half of the range, this opinion being based upon personal inspection.

In addition to the great copper mines developed and developing in the Cananea Mountains, there are other highly promising deposits of copper ore in various other fields of the Arizpe district, including prospects in the Sierra Manzanal, and remarkably rich surface ores in the Sierra Azul, or Ajo Mountains, to the eastward of La Cananea. In fact, nearly every municipality of the district of Arizpe shows more or less copper ore.

The Magdalena district is a gold field, primarily, but each of its six municipalities shows more or less copper, and many of these are not devoid of promise.

The district of Moctezuma ranks in importance second only to that of Arizpe, in the state of Sonora. There are large developed mines in the neighborhood of Nacozari, the hill on which the Moctezuma mine is opened being a body of cupriferous monzonite, too low in grade to work at present, but possibly available at some future time. Good mines of copper, carrying considerable values in silver and lead, are being developed in the vicinity of Cumpas, in the Moctezuma district and exploratory and development work on copper properties is noted at several other points.

The district of Sahuaripa, in the central eastern part of Sonora, has its eastern boundry on the line of the state of Chihuahua. The topography is exceedingly rugged, as a rule, but the district is better watered than some other portions of the state. Rail transportation is lacking, and the Yaqui Indians are very troublesome, at times, but the district is one of great promise for some future period when the Indian uprisings shall have been quieted finally, and cheap transportation is afforded by rail.

The Ures district contains a number of developing copper mines, in addition to mines of other metals, and while its production is small, at present, the time should come when rich and profitable copper mines will be steady producers of the metal.

TABASCO. The state of Tabasco has no copper mines, but is supposed to have copper ores near the Chiapas line, as the Santa Fé mine of Chiapas is but a very short distance from the state of Tabasco.

TAMAULIPAS. In July, 1907, the state of Tamaulipas was credited with the possession of eleven copper mines, of which only one or two are of present importance. There are copper deposits at a number of points in this state.

TEPIC. In July, 1907, the government statistics of Mexico credited the territory of Tepic with the possession of two copper mines, and there are mines of other metals carrying material copper values. Copper ores exist at a number of points in this territory, though the principal mining industry is based upon gold.

TLAXCALA. There are no recorded copper mines in the little state of Tlaxcala, but beds of copper ore outcrop near Monte Tlatlay.

VERA CRUZ. There are no copper mines in the state of Vera Cruz, but copper ores have been found in the district of Zomelahuacán, and probably exist at other points as well.

YUCATÁN. It is reported, though the statement does not seem fully verified, that for some centuries the Maya Indians have worked cop-

per mines, in a crude way, in the interior of Yucatán. The greater portion of this state was held, practically undisputed, by the war-like Mayas from the time of the Moctezumas until a recent period, the Spaniards finding it easier to leave the aborigines in undisputed possession of their territory than to attempt a conquest. Under the wise and pacific government of Don Porfirio Diaz the extension of the power of the Federal government over the entire state of Yucatán has been accomplished with very little bloodshed, through the exercise of great tact, patience and firmness. The interior of Yucatán is wild and little explored, but it is probable that considerable mineral values exist.

ZACATECAS. According to government records there were fourteen copper mines in the state of Zacatecas in July, 1907, the principal copper producing districts being those of Mazapil and Conception del Oro, south of Saltillo. The mines of Mazapil show a considerable variety of copper ores existing in large quantities, and this is a field of promise. The Bolaños and Ramos districts also are of slight present importance, and of considerable future promise.

CHAPTER XVII.

Copper Deposits of Central America and the Antilles.

In this chapter detailed references are made to the copper mines and copper producing districts of Central America and the West Indies. While the production from this field is small, these countries are not devoid of ore bodies of considerable promise.

COSTA RICA. Las Concavas mine, opened in the Eighteenth Century, or possibly earlier, was a small copper producer, at intervals, for many years, but has been idle for some time. There are outcrops of copper ores at several points in the republic, but no serious attempt at mining has been made except at Las Concavas. With the present large investment of foreign capital in Costa Rica, and the rapid extension of transportation facilities, further attempts at the exploitation of copper deposits would seem only a matter of time.

CUBA. The first American copper mines worked by Europeans are said to have been in Cuba, in the province of Santiago. There are copper mines, now idle, in the provinces of Matanzas, Pinar del Rio, Puerto Principe, Santa Clara and Santiago.

In the province of Matanzas copper ores are noted at El Recreo, a vein of one to twenty inches width having been traced for a distance of about a quarter of a mile.

In the province of Pinar del Rio copper is noted near Arroyo de Mantua, in the form of chalcopyrite associated with pyrrhotite, and with occasional chalcocite, occurring as lenticular chutes in metamorphic schist. and carrying strong limonite gossans.

In the province of Puerto Principe there are small mines that were worked many years ago, on fissure veins carrying chalcopyrite with quartz gangue, but none of these seem of especial promise.

The province of Santa Clara has copper ores at various points, including several localities northeast of Cienfuegos, and old copper mines are found at San Juan de Malaja, 6 miles northeast of the city of Santa Clara, and at the Finca San Joaquin, 12 miles west of Manicaragua, and also a short distance from Cumanayagua.

The mines of El Cobre, 8 miles west of Santiago Bay and about 30 miles north of Santiago de Cuba, were opened by the Spanish, A. D. 1532, the first production having been used for the casting of bronze cannon. The various mines were consolidated, in 1832, in the hands of an Anglo-Spanish company, and were worked until the plant was burned by insurgents, in the Cuban rebellion of 1868, producing, according to the custom-house records of Santiago, 610,200 tons of ore, exported to Swansea, averaging about 16 per cent. in copper tenor, and valued at $50,186,225, probably in depreciated Spanish currency. The ores of the Minas de Cobre occur in a mineralized zone of about 200 feet width, and of at least a mile

in known length, the belt showing several parallel veins, with rocks between much altered, the ore occuring as chutes with extremé widths of about 20 feet, and lengths of 20 to 200 feet, along fracture veins in serpentine. The ore is primarily chalcopyrite, associated with pyrrhotite, with quartz gangue, the grains of chalcopyrite frequently being coated with covellite.

GUATEMALA. The republic of Guatemala possesses considerable mineral wealth, but owing to lack of transport and rugged topography mining development is limited, being confined mainly to placer gold mining. With the completion of the Ferrocarril Guatemala del Norte, various cupriferous districts will be rendered accessible, and doubtless copper mining developments will follow. There were small copper mines in Guatemala under Spanish domination, as early as the Seventeenth Century, but metal production was mainly silver.

Small veins carrying massive malachite occur near Ravinal, in the department of Baja Verapaz, also near Cabulco.

In the department of Chuquimula, in eastern Guatemala, there are copper deposits, claimed to average 5 to 20 per cent. copper tenor, but these are idle, though they will be available for exploitation on the completion of the new northern railway. This department is mountainous and mineralated, but apparently rich in minerals.

In the department of Huehuetanango, on the southern slope of the Cuchumatanes Mountains, there are contact veins between limestone and granite, showing high grade carbonates. Near Chiantla there is an occurrence of copper ore said to resemble that of the Santa Fé mines of Chiapas, in Mexico. There are developed silver-lead mines in this department.

Copper carbonates are found in sedimentary beds not far from the city of Guatemala, in the department of that name.

HAYTI. There are deposits of copper ore at various points in the republic of Hayti, notably in the Hotte Mountain range, in the southern part of the island, and extensive deposits of copper ore, in and near igneous rocks of andesitic nature, associated with Tertiary limestones, are said to occur at Terre Nueve, about 10 miles from the seaport of Gonaives. There also are exposures of copper ore at Grande Riviere, south of Le Cap, 6 to 10 miles south of the sea, and at Limonade, copper ores carrying platinum, iridium and osmium are noted. Previous mining developments have been of the crudest, but efforts are now being made to develop a copper property along modern lines, with American capital.

HONDURAS. Copper ores occur in nearly every department of this republic, but development is limited, and the mines are of small size. There are copper mines in the departments of Tegucigalpa and Comayagua. In the department of Yoro, in the northwestern part of the republic, promising deposits of copper ore are reported from a district about 40 miles from the Ulloa river. This district is said to show a vein up to 14 feet in width, claimed to be traceable for miles, giving ores assaying 15 to 16 per cent. copper, which seems a statement liable to reduction.

JAMAICA. There is a cupriferous district near the middle of the island, showing several veins of 3 to 4 feet width, on which a little ex-

ploratory work was done, and from which one small shipment of ore was made, circa 1854. Since that date there have been repeated efforts to organize mining companies, and develop mines, but no permanent results have been secured. Apparently the deposits first opened were of small extent and of low value. There are indications of copper and other metals at various other points in the island.

LEEWARD ISLANDS. Copper ore has been noted on the island of Virgin Gorda, one of the Virgin Island group.

NICARAGUA. A very small amount of copper is produced in Nicaragua, as a by-product from the smelting of silver ores, the copper acting as a carrier in the matting of argentiferous sulphides. Occurrences of copper ore are noted along the Atlantic coast, and there are cupriferous belts on the Escondido and Mico rivers. The most promising ores are noted in the department of Segovia, but development is rendered difficult by a mountainous country and poor roads. Copper ores are noted also in the vicinity of Jinotega in the department of Matagalpa, in the department of León, and near Prinzapulca, on the gulf coast, in the department of Zelaya.

PANAMÁ. This newest of American republics has deposits of copper and other minerals, but lacks developed copper mines.

PORTO RICO. Copper mining in Porto Rico begun in 1869, when La Abundancia mine was opened, in the barrio of Rio Blanco, and this was followed by the exploitation, on a small scale, of several adjacent properties. The Rio Blanco deposits carry a vein of pyrrhotite of 6 to 10 feet width, with a paystreak of 8 to 15 inches, mineralized with bornite and chalcopyrite, the paystreak averaging 10 to 12 per cent. copper. Work was abandoned because of the heavy cost of transportation, after several hundred tons of rich ore had been produced. Copper outcrops are noted at various points along the mountain range that crosses the island from east to west, the richest being in the barrio of Rio Blanco.

Since the American occupation, numerous mining claims have been filed, but no actual mining has been done, except a little placer work for gold. At the end of 1906 eleven claims had been filed for copper, and one for iron and copper, these being mainly in the western end of the island, in the departments of Mayaguez, Arecibo and Ponce.

SALVADOR. Copper ores are noted in the department of Chalatenango, near the Honduranian frontier, and some attempts at mining in a crude way have been made. There also are copper ores near Melapán, in the department of Santa Ana.

SANTO DOMINGO. A little mining for copper is said to have been done by the Spanish, during the Eighteenth Century, but such operations must have been conducted on a small scale. The Sierra de Differencia, constituting the backbone of the island, shows copper ores at various points, the most important occurrences noted being near the Jaina and Nigua rivers, in the province of San Cristobal, on the northern side of the island, and on the southeastern flanks of the mountains, in the same province, about 25 miles northeast of the city of Santo Domingo. At the latter point ores are said to occur in tuffs, near the point of contact with Cretaceous limestone, the ores being chiefly chalcopyrite, associated with limonite, with some malachite and brochantite.

CHAPTER XVIII.

Copper Deposits of South America.

The cordillera of the Andes carries copper from its northern end in Columbia to Punta Arenas, at the southern tip of the continental mainland. Apparently the copper ores favor the western slopes of the cordilleran belt, as the principal mining fields lie mainly along the coast range, or between the coastal and central mountain ranges, largely in the tablelands between these two Andean ranges. There are occurrences of copper ore in Argentina and elsewhere, on the eastern slopes of the Andes, but these apparently are of less importance than the copper measures to the west. The principal cupriferous developments in South America are in the Republic of Chile, with Perú a good second, and there is every reason to believe that not only these, but other countries, will become increasingly important producers of copper.

ARGENTINA. The republic of Argentina has copper mines in the province of Buenos Aires, near the capital, which apparently are of small extent and little promise, and in the Andean provinces of Catamarca, Córdoba, Jujuy, Rioja, Salta, San Juan and Tucumán, of which the more important are in the province of Rioja. All of the latter named provinces are in the northwestern part of the republic, lying on the eastern slope of the Andes, in a rugged district offering serious obstacles to economical transport.

The production of copper by Argentina has been small for many years, but eventually should become important. The ores are mainly sulphide, but, like those of the eastern slope of the Andes, run largely to arsenical and antimonial forms, enargite being an ore of frequent occurrence.

In the province of Rioja is found the Famatina district, in a field of only about ten by fifteen miles area, which includes the Mexicana, Tigre, Caldera and Cerro Negro sub-districts. The Sierra de Famatina is a great mass of metamorphic rocks, 60 to 100 miles in width, with peaks of nearly 20,000 feet in height. Near Chilecito is a vast upheaval of geologically recent eruptives, showing copper ores in fissures. The district is very rugged, and difficult of access and transport. The mines of the Mexicana district occur at elevations of 13,100 to 14,800 feet, the veins being numerous, narrow and rich.

The Capillitas district, in the province of Tucumán, is very small, having an area of about 4 square miles only. The topography is exceedingly rugged, and there is no wood, and no water, except in the mines, which can feed the boilers, but are unable to supply water for mills. The Cerro de Capillitas shows a mass of fissure veins, forming almost a gigantic stockwerk, in granite, gneiss and porphyry, with a capping of trachyte. The ores developed are cuprite, melaconite, azurite and malachite, with a limited amount of bornite and occasional highly argentiferous tetrahedrite. It is probable that chalcopyrite will come in at greater

depth, but the richer ores in the alteration zone evidently are of considerable depth, and are both auriferous and argentiferous, as a rule..

BOLIVIA. Mines of both silver and copper were worked in Bolivia by the Incas. Geological conditions are somewhat similar to those found in the adjoining countries of Perú and Chile, but the exploitation of Bolivian copper mines has been hampered by a variety of disadvantages. The mines lie in the high cordilleran plateau and lack of rail transportation has been a serious drawback, but arrangements were made, in 1906, between the governments of Bolivia and Chile, for the construction of a rail line from Arica to La Paz, with a branch to Coro Coro, and the completion of this line cannot operate otherwise than as a great stimulus to production from the rich mines of the Coro Coro district. Most of the copper produced in Bolivia is shipped through the Peruvian port of Mollendo, though occasional shipments are made by way of Tacna, a Chilean port. The mining districts of Bolivia are arid, as a rule, and but slightly developed outside of Coro Coro.

There are copper mines in the departments of Aurora, La Paz, Litoral, Lipez Norte, Lipez Sur, Oruro, Pacajos and Potosí.

There are copper ores and mines at several points in the department of La Paz, but the most important mines of the department, and of the republic, are at Coro Coro. These mines are believed to have been worked by the Incas. The district is arid, and the only available local fuel is cofiga and cagajon. The nearest water supply is the Desaguadero river, 14 miles distant, which is a navigable stream, and copper is shipped by way of the port of Desaguadero. The Coro Coro district lies in the basin of Lake Titicaca, in the cordillera of Chacarilla, between the Andes to the eastward and the Cordillera Real, or coastal mountain range, to the west. This district shows two dissimilar sedimentary strata, apparently of different geological horizons, similar only in their origin and cuperiferous nature. The older and underlying formation, Las Vetas, is an arenaceous conglomerate of argillaceous tendencies, having a generally northeasterly trend. Superimposed upon this stratum is another conglomerate, Los Ramos, having a generally southwesterly trend. The upper conglomerate is much like the lower, but is darker in color and mottled with red and white particles of gypsum and other minerals in the older stratum. The country rocks are eruptive, mainly dioritic, and the copper occurs native as a rule, and but rarely as ores in quantities of commercial importance. The conglomerates range from 2 to 6 feet in thickness, with an extreme thickness of 50 feet in the Veta El Dorado, which has a minimum width of about 3 feet. These conglomerates carry native copper averaging about 2.5 per cent. with copper ores in small quantities, mainly chalcocite and domeykite, scattered irregularly through the beds, and native silver occurs sparingly. The mineralized district has been proven for about one-half mile in width and for about 5 miles in length, but traces of copper are noted for a considerably greater distance, and about 25 miles to the southeast what apparently is a continuation of these beds has been found, and mined slightly, while the same formation also outcrops still further south, in a region west of Poopo. The southerly continuations of the Coro Coro belt are difficult of access, though of considerable promise. The native copper occurs usually in small nodules, though masses, commonly of small size.

but sometimes large, are encountered at times. The silver associated with copper is mechanically admixed, but not alloyed, this method of occurrence of the two native metals being the same is in the Lake Superior district.

The Bolivian government estimates the average cost of copper production from the Coro Coro district, per quintal of practically one hundredweight, averaging 80 per cent. in copper tenor, at 5.34 bolivars for mining, 3.27 bolivars for milling and 1.39 bolivars for general expenses, a total of 10 bolivars for 80 pounds of fine copper. Cost of transportation to the coast averages 3.24 bolivars via Tacna, and 2.87 bolivars via Mollendo, the latter port taking the major part of the exports, with an average cost of ocean freight to European smelting ports of 2.78 bolivars per quintal, giving an average cost of 15.6 bolivars at Swansea and other principal British smelting points, with an average European price of 20 to 22 bolivars per quintal.

The departments of Lipez Norte and Lipez Sur show extensive remains of Inca workings, obviously for silver, with evidences of later operations by Spaniards. There are promising deposits of highly argentiferous copper ores in these departments.

The smelting point for the mines of Huanchaca, department of Potosí, is at Pulacayo, on the line of the Antofagasta & La Paz railroad, at a distance of 184 miles from the first named city. The Huanchaca mines lie at an elevation of about 17,000 feet. The vein is 3 to 9 feet wide, in intrusive micaceous andesite cutting Silurian slates. Pay ore occurs in chutes, and is mainly highly argentiferous tetrahedrite, associated with chalcopyrite, sphalerite, galena and pyrite, all argentiferous, with quartz and barite gangue. Selected ore is shipped to Antofagasta, where smelted, or forwarded to New York for reduction. Selected ore averages about 6 per cent. copper, 8 per cent. lead, 16 per cent. zinc and 1.5 per cent. silver.

The department of El Litoral is included by the Bolivian government in its copper statistics, but inasmuch as this department has been occupied by Chile since 1879, and is now part of the Chilean province of Antofagasta, and will not be given up by Chile except to superior power, which Bolivia lacks, its inclusion in any article dealing with Bolivia must be considered a patriotic reminiscence, rather than a fact of present importance.

BRAZIL. The existence of native copper and of various copper ores in Brazil has been known for many years, but few systematical attempts have been made at mining, until within the past few years, and official records are lacking in most cases. In fact, but for private enterprise very little authentic information would be available, and credit is due to Prof. A. J. de Souza Carneiro, of Bahia, for much of the information that has been gathered regarding Brazilian copper deposits.

The immense size of the republic of Brazil renders it altogether probable that deposits of copper will be found at numerous points, in addition to those now noted, and as a fair beginning has been made on copper mining and smelting, under modern conditions, in the state of Rio Grande do Sul, it is probable that this republic will become, sooner or later, a considerable producer of the metal.

A mass of native copper weighing 2,616 pounds was found many years ago in the neighborhood of the city of Bahia, in the state of that name, and now reposes in the royal museum at Lisbon. This state contains numerous copper deposits, but the only active mines of importance are at Carahyba. There are about a dozen districts in the state of Bahia where copper ores have been found in greater or less profusion, and in the majority of cases these copper measures would seem worthy of careful investigation. In addition to the mines of the Carabyba district, copper has been found to the north, near the Cerro de Barracha district, also at Patamuté, Urtigis and Curacá. In the central part of the state copper ore exists at the Cachoeira do Inferno and at Jacobina. In the western part of the state copper ores occur at Chapa da Velha, and in the eastern part ores are known on the Paraguassú river, near Cachoeira, at points near the city of Bahia, at Belem, Genipapo and Murihiba. In the south central part of Bahia copper has been found at Maracás, and in the southern part at Condeuba and along the line of the Rio Verde, near the boundary of the state of Minas Geraes.

In the state of Ceara copper ores exist at a number of points, and have been worked to a slight extent. The principal occurrences are near Buhira, in the municipality of Bucuosa, where abandoned explorations show native copper and cuprite. Copper also exists in the Cerro Cantagallo.

In the state of Goyaz various deposits of copper ore of more or less promise are noted on the Jaurie River.

In the state of Maranhao there are rich copper ores at a number of points, notably in the municipality of Chapado.

In the state of Matto Grosso copper ores of considerable promise are exposed at various points along the Jaurie River, which forms the boundary line between the states of Matto Grosso and Goyaz.

In the state of Minas Geraes, long noted for its gold mines, the occurrences of copper ore probably are of greater promise than are noted in any of the other Brazilian states except Rio Grande do Sul and Bahia. The principal occurrences are noted near Ouro Preto, Sete Lagoas and Lavras. At the latter point copper deposits, found in 1901, gave assays running up to 75 per cent., and a little mining work was done thereon.

In the state of Paraná copper deposits are known at Campo Largo, in the Carapuava district and along the river Parapanema.

In the state of Rio de Janeiro copper ores are noted in the vicinity of Campos and Sao Joao do Barra.

Copper exists in the northern part of the state of Rio Grande do Norte, near the boundary of the state of Ceara.

In the state of Rio Grande do Sul are found the principal Brazilian copper mining operations of the present day, at Camaquam, 3 kilometers from the Rio Camaquam, and about 80 kilometers from Rio Negro, a station on the Southern Brazilian railway. The formation shows an intrusive core of melaphyr, surrounded by conglomerate, ore occuring in the latter as chalcopyrite associated with pyrite, with occasional particles of chalcocite and showing occasional dendrites of native copper, gangue being of quartz. The veins occur as fissures in conglomerate and extend to the adjacent sandstone, but therein are not as rich as in the conglomerate, where four ore bodies are being worked.

These lack regularity, and even continuity, having an average width of about 4 feet and giving average assays of about 6.5 per cent. copper and 30 grams of gold, per metric ton. Elsewhere in this state copper ores are noted at Cacapava, where two small mines have been opened, and at Guarahina, Sao Gabriel, Cerro Martino and Cerro do Geraldo.

In the state of Sao Paulo chalcopyrite associated with sphalerite and galena has been found, in limestone, near Paranahaiba, but attempts at mining were abandoned, as the ore was found in small pockets only. Copper occurs also in the Sporanga Mountains.

CHILE. This country was, about the beginning of the last quarter of the Nineteenth Century, the largest copper producer of the world, but now holds only sixth place, having been passed by the United States, Mexico, Spain, Japan and Australia. The copper output of Chile has decreased, not only relatively, but actually, owing mainly to the exhaustion of the principal bodies of oxidized ores in the older mines. From this decline in output it must not be inferred that Chile is exhausted as a copper producer; on the contrary, the possibilities of copper production are greater than in almost any other country except the United States, Mexico, Canada and Australia. It will be necessary in the future, however, to obtain a much larger proportion of the product from sulphide ores than has been gained in the past. The production from sulphides of low and medium copper tenor is increasing, and with the increase of railroad facilities, and the better equipment of mines and smelters along modern lines, Chile must become an increasingly large producer of copper. The largest annual production ever made was about 43,000 long tons of fine copper in 1882, and total production from 1844 to 1900, inclusive, is estimated at 1,830,000 long tons of fine copper.

Copper deposits were worked in a limited way before the first white man set foot on the soil of Chile, and a little metal was produced under Spanish domination, but the industry did not gain real importance until during the fourth decade of the Nineteenth Century, after the gaining of independence. Until 1842 the high grade oxide and carbonate ores were smelted in charcoal furnaces, but in that year the first reverberatory furnace was built by Charles Lambert at Coquimbo, and in 1857 the first blast-furnace was built by the same pioneer. The period of greatest prosperity of the Chilean copper industry includes the three decades from 1850 to 1880, followed by twenty years of slow but fairly steady decline, with a turn of the tide, followed by improvement, setting in with the beginning of the Twentieth Century.

In 1903, according to the official records of the republic, there were in Chile patented mines as follows: copper, 7,106; gold and copper, 124; silver and copper, 427; copper and iron, 16; copper and lead, 4; gold, silver and copper, 38; silver, copper and lead, 14; silver, copper and cobalt, 1, a total of 7,730 cupriferous mines. The number of working properties was 748, not quite 10 per cent. of the total. In this connection it should be explained that a mine in Chile consists of one hectare, or pertenencia, many of the properties including a considerable number of pertenencias. The mining laws are very liberal, and the government cannot be accused of retarding the mining industry. Each holder of one pertenencia, of practically two and one-half acres, is taxed $10 yearly, and, after officially

surveyed, the property is freehold as long as taxes are paid regularly. Transportation facilities are poor, and there is considerable complaint of dishonesty and favoritism in the management of the state railroads.

Chile has two parallel copper belts, running nearly due north and south, along the axis of the Andes, these belts being approximately one hundred miles apart. The principal developments have been secured in the western or coastal belt, because of better transportation facilities. The cupriferous fields of Chile show mainly strata of the Permian system, with sandstones predominating. These have been much faulted, twisted, broken and upheaved by eruptive rocks, largely diorite. The auriferous copper veins of Atacama and Coquimbo usually are associated with highly silicious eruptives, while the argentiferous copper veins are associated commonly with diabase. General geological conditions are somewhat similar to those of the Mansfeld district of Germany, and in the Ural Mountain range of Russia, though the topography of Chile is much more rugged. The cordilleran belt, on the main chain of the Andes, lies back from the coast some distance, and the country is so mountainous, and the altitude is so great, and transportation facilties so poor, as a rule, that mining developments are on a scale that is trival, compared with the possibilities of great production from this belt. The two parallel cupriferous belts stretch from Perú on the north to nearly the southern end of Chile, in what formerly was called Patagonia, a wild country that has been divided between Chile and Argentina, the Andes forming the line of division. In the desert regions comprising the greater part of Chile, the oxidized zone usually is of great depth.

There are copper mines in the provinces of Aconcagua, Antofagasta, Atacama, Colchagua, Coquimbo, O'Higgins, Santiago, Tacna, Tarapacá and Valparaiso, with copper ores known to exist in practically all of the other provinces. Antofagasta, Coquimbo and Atacama lead in production and in the number of important mines.

The principal copper mines of the province of Aconcagua are in the department of La Ligua, where there are a number of important mines, and in the departments of Petorca and Putaendo.

In the province of Antofagasta there are mines of importance in several districts, including Calama, San Pedro de Atacama and Tocopilla, the latter being an old field. Important mines are being opened in the department of Gatico, under modern methods. In the Chuquicamata district the copper mines were worked originally for atacamite, this assaying 2 to 3 per cent. only in copper, but being reduced easily. Developments at depth, however, have shown much richer ores, ranging from 5 to 20 per cent. in copper tenor, and important developments are under way. The center of this field, 163 miles by rail from Antofagasta, has an average elevation of about 9,000 feet above sea-level. The richer ores, principally atacamite, occur in small veins, with gangue of quartz and feldspar, and ore as now mined averages 10 to 12 per cent. copper. In the Taltal district the rich gold mines of Guanaco have become copper mines at depth, a phenomenon noted at numerous other points in the world.

The province of Atacama has copper mines in a large number of departments and includes several of the most important copper districts of Chile. The ores mined in this province must average about 6 per cent.

in copper tenor to be profitable, unless specially suited for fluxing purpose in which case lower grades are utilized. Labor is inefficient, and pow drills run by compressed air prove unsatisfactory, owing to the great alt tude, while electric drills, for some reason not apparent, have not give satisfactory results. The department of Copiapó has a number of fam ous old producers, and some new mines of importance. Production i 1903 was 6,605 metric tons fine copper, from about 40,000 tons of ore, giv ing an average extraction of better than 15 per cent. for the entire dis trict. The department of Chañaral was the second largest producer i 1903, ores as smelted giving average returns of 8.6 per cent. copper. The Cerro Blanco district is in the cordillerean zone, with mines mainly in trachyte, opened for silver, but changing to argentiferous copper values at an average depth of about 600 feet, and deeper to copper sulphides of good average value, the deepest workings being about 1,500 feet. In the depart ment of Chañaral there are old and important mines, and the departments of Carmen Alto, Carrizal Alto, Freirina, Puquois and Vallenar have cop per mines of importance.

In the province of Coquimbo there is very general complaint about of San Vicente, but there are copper ores at numerous other points.

In the province of Coquimbo there is a very general complaint about both the scarcity and inefficiency of labor. In this province there are im portant mines in the departments of Coquimbo, Combarbalá, Guayacan, Illapel, La Higuera, Ovalle, Tamaya, Tongoy and Vicuña.

In the territory of Magallanes, in the extreme southern part of Chile, two veins of 5 to 7 meters in width have been found, carrying bornite and chalcopyrite, associated with hematite and limonite, with a quartz gangue.

In the province of O'Higgins there are copper mines, of more or less importance, in the vicinity of Rancagua.

In the province of Santiago the principal copper mines are at Lo Espejo and Melipilla, and in the department of Victoria.

The province of Tarapacá has copper mines, mostly small, near Iquique, Huantahaya, Huara and Tarapacá. Production by these mines is small, though they are by no means devoid of promise.

In the province of Valparaiso there are copper mines of some present importance, and of considerable future promise, near Llai-Llai and Quillota.

COLOMBIA. The production of copper is an industry of great age in the republic of Colombia, but one that never has assumed great importance. Considerable copper was secured during the centuries of Spanish govern ment, mainly from the rich oxidized ores at and near surface, extracted and smelted along primitive lines. There are old copper mines in the provinces of Antioquia, Tolima and Boyeca, the mines of the latter pro ducing a little copper for purely domestic uses. Copper also is found in the departments of Bolivar, Cauca, Cundimarca and Santander. The principal deposits of Cauca are at San Lorenzo, Yocoto, Coli, Pichinch and Andagueda. In the province of Colima copper ores exist near Anchiqu and at Nacoroco, southwest of Natagaima. With the improvement o transportation facilities, and the introduction of foreign capital that wi follow the more settled political conditions brought about by the wi government of General Rafael Reyes, the copper industry of Colombi

now of merely academical interest, should take upon itself proportions of commercial importance.

ECUADOR. This republic has copper deposits in the provinces of Azuay and Loja, and an attempt at mining on a modern scale was made, some years ago, but did not prove successful. Mining operations are confined mainly to the production of gold from a number of small mines, and copper ore is found frequently in small quantities in these mines. It is altogether probable that Ecuador possesses copper deposits of prime importance, in its mountainous mining fields, but developments to date are trivial.

PARAGUAY. There are deposits of copper ore at various points in the northern part of Paraguay, from which specimens of native copper have been taken, but no mines have been opened. Copper ores also are noted near Incarnacion, in the southern part of the republic.

PERÚ. This country was a small producer of copper for some hundreds of years, but about the middle of the Nineteenth Century the industry fell into decay, and its rejuvenation dates from shortly after the decline in the price of silver, around 1885, which caused the mines of the Cerro de Pasco district to utilize their rich ores of copper, previously thrown aside in the search for silver values. The immense investment of American capital in the Cerro de Pasco district, estimated at $17,000,000 gold, promises to revolutionize the copper industry of Perú. Among the disadvantages of Peruvian mining are the tremendous height of the mountains, which have taxed the engineering skill of man to pass, the lack of fuel in certain districts, and the inefficiency of labor, which is inclined to be both drunken and lazy, a state of affairs scarcely to be wondered at, in view of the padrone system in quite general use.

Perú is the second largest copper producer in South America, and in 1906, made 13,474,332 kilograms fine copper, a gain of 1,261,332 kilos over the preceding year, the production amounting to about 2 per cent. of the world's total supply of the metal. According to the official Peruvian statistics of 1900, there were in Perú 104 copper mines, 104 mines of silver and copper, and 2 mines of gold, silver and copper, which number had increased, in 1905, to 349 copper mines, 1,022 silver and copper mines and 351 copper and lead mines, a total of 1,722 cupriferous properties, showing a gain of more than 700 per cent. in five years.

Perú has the usual ores of the Andean cordillera, with geological surroundings similar to those of Chile. Copper ores are scattered all along the Peruvian Andes, and down to the coast. The principal ores are bornite, chalcopyrite, enargite and tetrahedrite, there being an unusual proportion of arsenical and antimonial minerals among the minor ores, found in considerable quantities in various places, with occasional native copper, cuprite, malachite, bournonite and chalcanthite, usually associated with sphalerite and frequently with galena, all ores being more or less argentiferous.

In addition to copper ores in practically all of the other departments, Perú has copper mines in the departments of Ancachs, Arequipa, Cajamarca, Huancavelica, Huánuco, Ica, Junín, Libertad, Lima and Puno.

In the department of Ancachs the production of fine copper in 1906

was 440 metric tons, the district of Pallasca leading with 229 metric tons, followed by Recuay with 154 metric tons, balance of production being from the districts of Bolognesi, Cajatambo, Huallas and Huari.

The department of Arequipa produced 102 metric tons of fine copper in 1906, from the districts of Arequipa, Acarí, Camaná and Islay, the formerly important district of Acarí furnishing less than 9 tons of this small output.

The production of the department of Cajamarca, in 1906, was 183 metric tons, the Cajabamba district leading with 137 tons, with small products from the Contumazá and Hualguayoc districts.

In 1906 the production of fine copper from the mines of the department of Huancavelica was 254 metric tons, the district of Castrovirreina leading with 234 metric tons, followed by small products from the districts of Angaraes and San Juan. This department, which lies a long distance nearly due south of Cerro de Pasco, shows copper ores in promising quantities, mainly in eruptive rocks. The ores smelted in 1905 averaged about 25 per cent. copper, and 0.1 to 0.135 per cent. silver.

The department of Huánuco produced, in 1906, fine copper to the extent of 235 metric tons, of which the district of Huánuco made 141 metric tons, and the district of Huallanco 94 metric tons.

The 1906 production of the department of Ica was only 28 metric tons fine copper, all coming from the district of Ica, which was worked extensively at one time, but was practically abandoned in 1892. The largest mine was the Canza, with selected ores averaging about 30 per cent. copper, lower grades being rejected. Disadvantages in this district are lack of water and of decent roads for transportation.

The department of Junín is much the most important copper field of Perú, and is of great promise. The output of fine copper, in 1906, from the various districts of this department, was 9,440 metric tons, of which 6,741 metric tons came from the Cerro de Pasco district, with 2,697 metric tons from the Yauli district. The district of Huancayo produced only 2,156 kilos fine copper.

The Cerro de Pasco district, worked for nearly 300 years for silver, and an enormous producer of that metal, has become a very important copper field, since 1890, and is now mainly in the hands of a single American corporation. Unlike most of the other Peruvian mining fields, which are arid, there is an excess of water at Cerro de Pasco, and there are numerous streams that could be made to furnish power. Timber is scarce, except in a few districts difficult of access, but coal of fair quality is found in abundance, within 20 miles, and a branch railroad has been built to the coal fields. An extension of the Meiggs railroad has been built from Oroya to Cerro de Pasco, cutting to a comparatively trivial sum the former freight rate of $40 per ton for this distance, all transportation having been on the backs of mules and llamas. The Cerro de Pasco district is a basin of approximately one mile width and two miles length, entirely mineralized and bounded on the west by andesite, with limestone on the three other sides. The formation is in some doubt as to age, but apparently is lower Cretaceous, with strata of slate, sandstone and limestone, upon which is superimposed a mass of limestone conglomerate, of marshy rather than marine origin, fractured by eruptive acid andesite rocks, that

in many cases engulf the sedimentary strata, the limestone being highly metamorphosed. Apparently the entire basin in a mammoth stockwerk, with impregnations of silver and copper ores, the ore occurring in immense pockets, up to hundreds of thousands of tons in weight, and largely, though less frequently, in veins. The deposits are said to be metasomatic at the western end, east of the andesite, occurring mainly as veins in or near the andesite, while to the eastward, west of the limestone, the ore occurs in large pockets, in and near the limestone. The alteration zone is 200 to 300 feet in depth, succeeded by a zone of lean cupriferous pyrites, followed in turn by highly argentiferous sulphides and arsenides. Below the water-level the ores include bornite as well as chalcopyrite, with considerable tetrahedrite, associated with sphalerite, galena, arsenopyrite and pyrite.

The Huayllay division is about 25 miles southwest of Cerro de Pasco, at an elevation of about 15,000 feet. Copper occurs at various points, mainly as enargite, with considerable tetrahedrite and some chalcopyrite. Bismuthinite is shipped in considerable quantities from one property, and there are a number of old copper mines, mostly small, in this field.

The Yauli division of the Cerro de Pasco district is a short distance east of Oroya, the principal copper deposits occurring between wollastonite strata and andesitic rocks, such as dacite and prophyllite. The Morococha sub-district of the Yauli division has a number of important producing mines, and is located on a 10-mile spur of the main line of the Oroya railroad that runs from the western end of the Galera tunnel, which passes under Mount Meiggs. The Yauli mines, including the Morococha sub-division, are located at an average elevation of more than 13,000 feet above sea-level.

The department of Libertad produced, in 1906, only 74 metric tons fine copper, of which 73,654 kilograms came from the district of Santiago de Chuco, and only 690 kilos from the district of Salpo.

The department of Lima is the second largest producer of Perú, having made 2,547 metric tons fine copper, all from the district of Huarochirí, in 1906.

The American consul at Iquitos writes that prospectors on the upper Maranón river, an affluent of the Amazon, found copper in the dumps of a half dozen abandoned mines, worked by Spaniards previous to the Peruvian War of Independence, at a distance of three weeks journey from Iquitos.

The production, in 1906, of the mines of the department of Puno, was 187 metric tons fine copper, all from the district of Lampa.

URUGUAY. Mining is but little developed in this republic, and while copper ores have been found at various points, no serious attempts have been made at developing copper mines.

VENEZUELA. Venezuela has produced no copper since 1894, but was a producer of importance at one time. Copper ores are known to occur in the departments of Baraquisimetó, Carabobo, Lara and Mérida, but the only mines of importance have been developed in the department of Lara.

There are traditions that the Quebrada mines, in the Aroa district of Lara, were worked by aborigines, before the coming of the Spanish. In the first half of the Nineteenth Century a Baltimore company operated

several of these mines, securing therefrom about 43,000 tons of high grade carbonate and oxide ores. Later the mines were taken over by local capital, and circa 100,000 tons of medium and high grade ores extracted. The principal period of production was in the years 1872 to 1894, when fine copper to the extent of about 65,000 tons was produced. The Quebrada mines are developed on the Narvaez or Bolivar tract, of 1,150 square miles, between the Tocuyo and Yaracuay rivers, granted to one Narvaez, by the Spanish crown, in 1598, and passing, in 1802, by marriage, to the ownership of Simon Bolivar, the liberator. The developed cupriferous portion of this tract shows strata of slate and limestone, intruded by various eruptive rocks, the ore occurring in lenses, frequently of considerable width and length, and of unknown depth, the lenticular bodies occurring in series with a strike of nearly north and south. The usual oxidized ores are found at and near surface, succeeded by chalcopyrite at slight depth.

The copper measures of Venezuela obviously are of importance, even if judged solely by past production from a single district, and when the present unsettled and unsatisfactory political conditions are adjusted, Venezuela will resume its position among the important copper producing countries.

CHAPTER XIX.

COPPER DEPOSITS OF EUROPE.

The copper deposits of Europe are described briefly in this chapter, in alphabetical order, by countries.

AUSTRIA. Copper has been mined and smelted in Austria for centuries, and it is probable that copper mines were worked in Roman times. The industry is now of comparatively little importance, employing only about 1,000 men, with an average annual production of between two and three million pounds fine copper. The principal mines of Austria are in the Tyrol, where there are about a half dozen small mines in operation. In southeastern Bohemia there is an extensive area of sandstone and slate, containing veins carrying impregnations of copper ore, mainly chalcocite, and the Graslitzer mine of this district was perhaps the most celebrated copper mine of mediæval times. There also are a few small mines in Salzburg, near the city of that name.

BOSNIA. The production of fine copper from the mines of Bosnia was only 39 metric tons in 1905, a heavy falling off from the output of 237 tons in 1901, in which year the output was secured from 4,747 tons of ore smelted, giving an average extraction of almost exactly 5 per cent. A little ore is mined and smelted at Sinjako, and small quantities of ore are sent to Hungary for smelting.

BULGARIA. The principality of Bulgaria has copper mines in the provinces of Bourgos, Vidin and Vratza, and 1,400 tons of ore are estimated to have been produced in 1904. There are evidences of copper mining operations in Roman times, and possibly at an even earlier period. In the province of Vratza, near where modern mines are operated, there are considerable slag-piles, remaining from ancient smelters of a date so remote that no vestiges are found of the works themselves, and in other provinces there are similar but smaller slag-dumps, with waste-burrows containing mere traces of lean ore, the values of which have been leached most effectually by the rains of twenty centuries.

At Plakalnitza, in the province of Vratza, the ore is mainly bornite, with occasional chalcopyrite, and a little malachite in the upper workings.

In the province of Bourgos, chalcopyrite in considerable quantities is found at Kara Bair, immediately west of the port of Bourgos, on the Black Sea, and there are remains of copper mining operations dating from some remote period. At Kara-Tepe and Soulon-Dere there are ores ranging up to 40 per cent. in copper tenor, on which some mining has been done, in no case exceeding 100 feet in depth.

At Belogradchik, in the province of Vidin, mines are being developed on ore bodies yielding mainly chalcopyrite. At Milkiovtzy, in the district of Trn, there are small ore bodies showing malachite, chalcocite and chalcopyrite, with gangue of barite.

In the department of Sofia, not far from the capital, in the extreme

western part of the principality, chalcocite is found at Gornya-Danya and at various other points. Native copper and rich oxidized ores have been noted in the districts of Sleven and Samakof, and elsewhere.

CORSICA. The island of Corsica has a cupriferous district about 20 miles wide by 50 miles in length, showing copper ores, mainly sulphide, in contact deposits between limestone and igneous intrusives. In this district there are a number of small and unimportant mines, mostly of considerable age, of which the Lancone mine was once a considerable producer. The present copper production of Corsica is trivial, coming mainly from a single small mine that ships about 200 tons of ore yearly to Great Britain.

CYPRUS. The Latin word cuprum, from which comes the English word copper, and its equivalents in most of the other European languages, is derived from aes cyprium, the earliest Latin name of copper, derived from the name of this island, where the Romans first secured their supplies of the metal, and it is probable that copper mines were worked by the Greeks before the Romans. The latest attempt at modern mining, early in the Twentieth Century, was in the vicinity of Limassol, but the island now has no active copper mines.

ENGLAND. English tin was known to the Phoenicians nearly or quite three thousand years ago, and copper has been produced, in all likelihood, for as many years as tin, the same veins carrying both metals, in Cornwall and Devon. At the close of the Eighteenth Century England occupied relatively the same position in the copper industry as held by the United States one hundred years later, producing 55 to 60 per cent. of the copper supply of the world, and, including the Welsh mines, then large producers, Great Britain was as important a factor in the copper trade, at the beginning of the Nineteenth Century, as North America is in the same trade at the present time. In 1799 the output of copper by English mines was 4,923 long tons, but had shrunk, in 1899, to 367 tons.

The mines of Cornwall and Devon, adjoining counties in the southwestern corner of the island, have been important producers of tin for a hundred generations, and it is no wonder that the Cornishmen are counted the world's best practical miners. A small, though relatively important production of copper, was secured from these counties during the middle ages, but systematic copper mining may be said to date from about A. D. 1700. The quantity of copper ore produced by the mines of Cornwall and Devon, during 126 years ending with 1865, was 7,844,305 long tons, valued at £50,964,388. The average yield for the last 70 years of this period was about 8 per cent. fine copper. The metalliferous belts of Cornwall and Devon may be considered as one geographically, occurring in a district showing metamorphosed sedimentary rocks, mainly clay-slates of the Devonian system, with frequent bosses of granite, both slate and granite being intruded by a quartz-porphyry of later age. There are numerous fissure veins cutting all of these rocks, these averaging 2 to 3 feet only in width, and frequently showing prominent gossans, the cappings being more numerous and stronger above copper ores than above the tin ores. The same veins carry ores of tin and copper, but there is a marked segregation of these minerals, governed by the nature of the wall-rocks, tin occurring mainly in portions of the fissures traversing granite, while copper favors

the slates. There are exceptions to this rule, and in places tin and copper alternate in occurrence, but, in the main, the metals favor the different rocks as noted. As a rule the veins are best mineralized where having the sharpest dip. The copper ore is mainly chalcopyrite, with quartz gangue, but the upper workings show the usual oxidized ores and native copper. One mass of virgin metal, weighing three tons, was secured from a mine near Mullion, Cornwall. The secondary sulphides are found to some extent, and copper silicates occur in small quantities, while there are occurrences of many of the rarer copper minerals, of scientific interest rather than of commercial importance.

The county of Cumberland was a producer of copper from a number of mines at one time, but these have been idle for a century or more. The Goldscope, in this county, was the most famous English copper mine during the Tudor era, working a fabulously large force of men to obtain the very moderate amount of copper secured.

The county of Cheshire contains numerous deposits of oxidized ores, averaging about 1.5 per cent. in copper tenor, disseminated in sandstone, which are not of present commercial importance, though possibly of future value.

There are deposits of copper in western Shropshire, along the Welsh border.

In Staffordshire the Ecton mine, owned by the Duke of Devonshire, was opened in Roman times, and was operated as recently as 1840. This was the first English mine to use gunpowder for blasting, in 1677.

The Laxey mines, in the Isle of Man, produce lead, zinc, copper and silver, the principal values being in the two metals first named.

FAROE ISLANDS. On the western side of the island of Luderö there are a number of superimposed cupriferous amygdaloidal traps. The copper occurs in thin vertical sheets, as virgin metal, of about one thirty-second inch in average thickness, and some of the gangue rock, from which metallic copper of appreciable size had been removed, assayed 1.88 per cent. copper.

FINLAND. The grand duchy of Finland, which, though closely bound to the Russian Empire, is not a portion thereof, as quite generally considered, has copper mines in the provinces of Viborg and Kupio. The most important is the Pitkaranta, on the northern shore of Lake Ladoga, in the province of Viborg, where mining dates from about the middle of the Nineteenth Century. The ore is mainly chalcopyrite, occurring in veinlets and disseminated in beds of "skarn," or sahlite, which is a granular mixture of augite, granite and ferromagnesian silicates, traversing granite. The ore body averages about 15 feet width, and is low in grade, but has been developed more or less extensively for about one and one-half miles in length.

FRANCE. There are no copper mines of present-day importance in France, the old mines of Chessy, which were famous properties and considerable producers in the middle ages, having been exhausted and idle for many years. In 1903 French copper production was 10,900 metric tons of cupriferous pyrites, of an average value of $13.25 per ton, a considerable portion of the value being in the sulphur contents, coming mainly from the department of Ariege, with a small output from the department of

Gard. The production is principally from mines of cupriferous pyrites at St. Bel, northwest of Lyons, where the ore occurs in series of lenses having a known length of about 1,300 meters. One of the lenticular masses is of mammoth size, having an ascertained thickness of 140 feet, at the depth of 544 feet, with a known length of 1,968 feet, consisting of massive pyrite with a little intruded quartz, slightly cupriferous. There also are small mines of argentiferous tetrahedrite in the department of Ariege, and in 1900 the production of such ore was 1,184 metric tons, valued at 612,393 francs, mainly in silver, sent to Great Britain for smelting.

There also are small copper mines in the department of Var, and in Savoy. There are very small copper mines in the department of Isere, and in the Basses-Pyrenees some exploratory and development work was done in the early years of the century. At Cap Garonne, near Toulon, there are Permian quartz-conglomerates carrying a cupriferous bed of 2 to 4 feet thickness, the lower portion mineralized with chalcocite and melaconite.

GERMANY. In production and importance, the copper mines of Germany rank second in Europe only to those of Spain, and the Germanic copper industry is of considerable antiquity, the Mansfeld mines having been important producers in the middle ages. In 1799 Germany produced only 372 long tons of fine copper, nearly all from the Mansfeld mines, and one hundred years later made 20,875 long tons, of which about 90 per cent. was from the Mansfeld mines.

There are copper mines of greater or less importance, and other mines carrying cupriferous values, in Bavaria, Brunswick, Elsass, Hanover, Hessen-Nassau, Prussian Saxony, Rheinprovinz, Saxe-Coburg-Gotha, Saxe-Meiningen, Saxony, Silesia, Weimar and Westphalia.

The copper mining industry of Saxony is of overwhelming importance, values being secured mainly from a single property in a single district, though there are cupriferous quartz veins in Schneeberg. The production of Saxony, in 1904, was 710,911 tons of ore, from three mines, of which one, the Mansfeld, is one of the world's greatest copper producers, while a second, the Rammelsberg, is of considerable importance.

The Mansfeld mines are at Eisleben, in the southern Harz Mountains. In this portion of the Ober Harz the copper occurs in rocks of the Permian system, resting unconformably upon crystallized strata of Paleozoic rocks, the metalliferous bed lying in the Zechstein, a member of the Permian formation. These horizons of the series consist mainly of unstratified gypsum, associated with bituminous dolomitic limestones, beneath which is a stratified fetid limestone, below which lies the true Zechstein, giving name to the formation. At depth this passes into a bituminous marly shale, the lowest part of which, ranging from 18 inches to 3 feet in thickness, forms the cupriferous strata, carrying disseminated copper sulphides to the extent of 2 to 5 per cent. copper, with an average tenor, as mined, of about 2.8 per cent., and carrying an average of about 0.15 kilos silver per metric ton. Under the cupriferous shale is a calcareous sandstone-conglomerate, sometimes carrying disseminated copper carbonates, and containing also small values in cobalt and nickel, all of the ore being more or less argentiferous. The copper-bearing shales of the Mansfeld district are about 200 square miles in area.

The Rammelsberg deposits, in the northern Harz Mountains, two miles south of Goslar, Prussian Saxony, occur in lenticular bodies of banded ore, with layers conformable to the bedding of the Goslar slate, in folded beds of Devonian age. The Rammelsberg is the second largest copper producer of the German Empire.

In 1904 the production of Westphalian mines was 47,718 metric tons of ore, secured from three copper mines and as a by-product from eighteen mines of other metals, and in the same year two copper mines in Silesia produced 1,760 metric tons of copper ore.

GREECE. The first Grecian copper mining was done at Chalkos, in the island of Eubœa, in semi-historic times, and the Greek name of the metal, chalkos, came from this source. The eastern coast of Attica shows argentiferous sulphide ores of lead and zinc, including the important silver-lead mines of Laurium, the argentiferous galena and sphalerite carrying occasional chalcopyrite. Copper ores occur in small veins only, as a rule, in eastern Attica, but in 1907 one copper mine was being worked, in a small way.

There are deposits of copper ore in Thessaly, but apparently these are not of large size or especial promise.

HERZEGOVINA. This country, nominally under Turkish suzerainty, but actually administered by the crown of Austria-Hungary, has a few small and exceedingly primitive copper mines, but none worthy of serious consideration, as now developed.

HUNGARY. Copper mining is an industry of great antiquity in the kingdom of Hungary, and there is a considerable number of old mines, mostly worked out or idle, and nearly a dozen copper smelters, all small and antiquated in design. Sulphide ores predominate as a rule. In 1901 the production of copper ore in Hungary was 161,547 metric tons, from 16 working mines, of which five produced the bulk of the ore won, and, of the larger producers, three mines were owned by the government and two were under private ownership.

There are copper mines in Transylvania, in the eastern portion of Hungary. The copper measures of the Banat, formerly worked for copper values, are now producers of iron ore only, though auriferous copper ores are found as contact deposits at the junction of garnetized Tertiary limestone and intrusive monzonite. At Herrengrund, north of Neusohl, near the Galician boundary, there are small copper mines, and at Dognacska there are very old and very small mines, that are limited producers of copper sulphides.

IRELAND. In 1906 the copper production of Ireland was about 3,000 tons of low grade cupriferous pyrites, valued at about £4,000 only, a considerable proportion of the values being in sulphur. At one time the Irish copper mining industry was of much importance, the production of the Connecree mines being 677 tons of fine copper in 1799, equivalent to nearly 8 per cent. of the world's production in that year, while in 1899 the Irish output was only 17 tons of fine copper, all obtained by leaching and cementation. The Irish copper ore sold in Swansea and Liverpool, from 1875 to 1882, amounted to 670,681 tons, of 21 cwts. each, valued at upwards of £1,000,000, but after 1882 the copper mining industry was practically extinct for

twenty years, though efforts are now under way to revive the industry. The Irish copper mines, however, have been material contributors to the progress of the industry, the wire rope tramways now in general use having been invented by Chas. Hodgson, of Wicklow, for use in the local mines, and the single rail was first utilized by Capt. Geo. Oates at the Cronnebane mine.

The Irish copper ores are mainly chalcopyrite and cupriferous pyrite, and there are copper mines in the counties of Cork, Kerry, Waterford and Wicklow, and in addition there are copper deposits in County Tipperary.

In County Cork the principal cupriferous districts are in the western part, including the Berehaven district, where mines were worked early in the Nineteenth Century, the Schull district and the Crookhaven and Kilcrohane districts.

The copper measures of County Cork extend into the adjoining county of Kerry, where mines have been opened at various points, including Ross Island in Lake Killarney. The Mountain and Keallonge mines, operated during the early decades of the Nineteenth Century, were each more than a quarter of a mile in depth, and were considerable producers in their day.

In County Waterford the Knockmahon mines were large producers at one time, the output of finished copper from the mines of this county exceeding 900 long tons in 1843. The ore is mainly cupriferous pyrite, occurring in large bodies in clay-slate, and, as selected, gave average returns of about 10 per cent. copper. The cupriferous measures of this county would seem worthy of serious exploitation.

In County Wicklow the Cronnebane mine was the principal property, and, as early as 1799, the Connecree mines yielded 677 tons of fine copper, rendering this one of the largest copper mines of that period. Copper mining practically ceased about 1840, but there was a small production of more or less cupriferous pyrite from the old copper mines for several decades later. In the Ovoca Valley of Wicklow, sulphide ores occur in clay-slates, as in the adjoining county of Waterford, and as in Cornwall and Devon. The ore occurs as chalcopyrite, in small veins, and as cupriferous pyrite, in lenses in Silurian slates, near granitic intrusives. The Ovoca copper belt is about six miles in length, and is of considerable promise, though the average grade of the ore is low.

ITALY. Copper was mined in Italy by the Romans several centuries before the Christian era, and, before their day, in semi-historic times, mines were worked by the Etruscans. The copper production was small during the middle ages, but the industry never has suffered complete cessation since its birth. Several of the Italian copper mines are well equipped, and managed with technical skill, and production is increasing. In 1902 the output of all Italian mines was 101,142 long tons of copper ore, and in 1907 probably was considerably more than twice as large.

The Italian copper deposits of commercial value occur mainly in the Appenines of Northern Italy, in the departments of Liguria, Piedmont, Tuscany and Venetia, those of Tuscany being of the greater importance. The principal mines are in the districts of Volterrano, Grosetto, Liguria and in the western Alps.

Principal developments and production are in the Grosetto district, where the largest Italian copper company is operating, in the vicinity of

Massa Marittima, the Massa Metallifera of Roman days. The Grosetto district lies ten to twenty miles southeast of Leghorn, in the foothills of the Etruscan Appenines. The principal ore bodies occur in fissure veins, in a great laccolith of gabbro and diorite intruding Eocene limestone, the intrusive rock being strongly basic, with an altered crushed zone of serpentine. In this district are to be found the largest Italian producers.

The Ligurian mines, above Genoa, lie near the Mediterranean coast, the ore bodies occuring in stratified Azoic rocks, as contact veins between diorite or serpentine and the metamorphic rocks, the ores being mainly sulphide, with quartzose gangue.

The ore of the Volterrano district is mainly chalcopyrite, with a small quantity of chalcocite found in fissures in a red gabbro, known locally as porfido rosso. This district has been the scene of copper mining operations from very early times.

In the Piedmont district mines were worked in Roman days, and traces of old workings are to be seen at many points. The ores occur in stratified archaic rocks, no fissure veins being found, and nickel and cobalt frequently are associated with copper.

In the island of Sardinia there are copper deposits near Freigas, on Monte Tramento, in a bed of clay-slate alternating with limonite schist, the copper ores occuring near the contact and showing considerable chrysocolla above, with chalcopyrite below. There are minor copper deposits, mainly in small bodies and of low grade, at several other points in Sardinia. In 1905 the production of Sardinia was 98 metric tons of copper ore, all from the province of Cagliari.

LUXEMBURG. There is a small copper mine at Stolzenburg, near Diekirch, opened 1896. The vein averages about 20 inches in width and carries ore of good copper tenor.

NORWAY. The copper mining industry of Norway is of considerable antiquity, and in 1799 Norway produced 480 tons of fine copper, mainly from the Röros mines of Trondhjem, and one hundred years later the output was 3,935 long tons of fine copper, Norway being one of the few European countries to increase its copper output during the Nineteenth Century. Most of the Norwegian mines are opened on lenses of cupriferous pyrite, some of these lenticular masses being of large size. As a rule the lenses have a nearly vertical dip, but are deep rather than wide, being comparable in shape to eggs on end, rather than to the ordinary lenses having their greatest length along their axes of strike.

There are copper mines in the provinces of Christiania, Christiansand, Trondhjem and Tromsö. The principal mine of the present day is the Sulitjelma, in the amt of Nordland, stift of Tromsö, north of the Arctic circle. The country rock is mica-schist, of lower Silurian age, with eruptive greenstone flows conformable with the schist, the ore bodies occurring as extended lenses, very persistent in strike and dip, on the contact of the schist with metamorphosed amphibolite and olivenite gabbro, the ore being exclusively cupriferous pyrite, averaging 2.25 per cent. copper, with small quantities of nickel and silver, and of good sulphur tenor.

In the stift of Trondhjem are the Röros and Meraker districts, the oldest copper fields of Norway, and among the oldest in northern Europe, which

remain producers of some present importance. In these districts the ores occur as sulphides, in schist and slates of lower Silurian age.

In Telemarken, Christiansand, there are a number of old mines carrying numerous veins of sulphide ore, mainly of narrow width but great persistence.

PORTUGAL. The important copper mines of Portugal are all in the province of Alemtejo, near the border line of the Spanish province of Huelva, but there are a few small properties in the southern province of Algarve, next south of Alemtejo. As the mines of Alemtejo are opened on the western extension of the Sierra Morena, their geology is practically the same as that of Huelva, described in the article on Spain. The principal Portuguese mines are in the districts of San Domingos, Grandola and Aljustrel, production averaging about 500,000 long tons of cupriferous pyrite annually.

ROUMANIA. There are no large copper mines in this kingdom, the principal producers, all very small, being in the Mehedintze district. In the Carpathian Mountains carbonate ores and chalcopyrite, slightly argentiferous, are found at Valea Choboroasa. Copper ores also exist near Salishtea and in the district of Dobroudja, at the towns of Balabancea, Islam-Geafer and Carapelit, also at Altan-Tepe, near Tcheamourli.

RUSSIA. There are extensive cupriferous districts in the Russian Empire, those of Siberia being treated separately in the chapter on copper deposits of Asia, with the exception that the Transcaucasian copper mines are included in this article on Russia, as also are the copper measures on the eastern slope of the Ural Mountains, that lie in the governments of Perm and Orenburg, each of these divisions lying partly in Europe and partly in Asia.

There are copper mines in the governments of Perm, Orenburg, Ufa and Samara along the Ural Mountains, and in the governments of Viatka and Kasan, next west. In Transcaucasia there are mines in the governments of Elizabethpol, Kutais and Tiflis. In the Russian Empire there are a considerable number of copper mines and nearly or quite 30 smelting plants, mainly small and antiquated in design, though a few properties, notably the Kiadebek, have modern reduction works. The comparatively small output of Russian copper is no criterion of the possibilities of production inherent in the copper measures of this, the greatest empire in existence, and there are various fields of much promise awaiting extensive exploitation at some future time.

The Permian formation, taking its name from the government of Perm, is very extensive, being found in the governments of Perm and Orenburg, on both sides of the Urals, and in the adjoining governments of Ufa, Samara, Kasan and Viatka. The mines of these governments are opened in Permian and Triassic formations, the ores occurring oxidized, and of low average tenor, not to exceed 2 to 3 per cent., but with occasional enrichments, notably as massive malachite, of excellent average tenor. The bedded deposits of the western slope of the Urals are mainly of Permian age, with some cupriferous strata of Triassic age. Among the Permian mines of interest is the Miednoroudiansk, where a single body of massive malachite weighing 339 tons was extracted in 1836. At depth the pockets of carbonate and oxide ores pass into chalcopyrite and cupriferous pyrite.

The Transcaucasian mines, in the three governments of Elizabethpol, Tiflis and Kutais, furnish about half the copper production of the empire. In the Kedabenski district of Elizabethpol, ore occurs as irregular lenses, often of large size, in veins with quartz-porphyry gangue, with walls of diorite and diabase porphyrite, the lenses shading gradually into the country rocks. The ore is a mixture of slightly auriferous and argentiferous covellite and chalcopyrite, carrying sphalerite and occasional galena, associated with pyrite and pyrrhotite, with a heavy barite gangue.

Copper ores were worked in a small way, toward the end of the Eighteenth Century, near Kielce, in Russian Poland, and were reopened for a short time in 1904. There also are old copper mines at Chenciny, Poland, carrying mainly carbonate ores, on which some efforts at mining have been made since the beginning of the Twentieth Century.

SCOTLAND. There are old copper mines, which never were of importance, in Renfrewshire and Rosshire, with deposits of chalcopyrite, apparently of some promise, in Perthshire, and occurrences of copper ores are noted in Kirkcudbrightshire.

SERVIA. There has been a small but fairly continuous copper industry in Servia for some hundreds of years, and it is possible that copper mines were operated by the Romans. The production of fine copper by Servian mines in 1900 was 270 metric tons.

The principal producing copper field is in the vicinity of Majdenpek, and in the adjoining districts of Rebelj and Wis, in northwestern Servia, in the basin of of the Yablonica river, the copper belt running for about 15 miles northwest and southeast along the northern slope of the Povljen Mountains. The Rebelj deposits occur in serpentine, with intercalated argillaceous limestone, in lenses up to 100 feet in length, carrying a core of crystalline pyrite with disseminated chalcopyrite averaging about 5 per cent. copper, with the outer shell of the lense carrying ore up to 15 per cent. in copper tenor. There also are deposits of copper ore at Radanovci, Staninareta and Wuinovatz.

SPAIN. Of all the producing copper fields of the present age, the Hispano-Portuguese cupriferous measures of the provinces of Huelva and Sevilla in Spain, and the provinces of Alemtejo and Algarve in Portugal, are the most ancient. The first copper mining on the Iberian peninsula was done, in all likelihood, by the Phœnicians, some three thousand years ago, and was continued by their kindred, the Carthaginians. Upon the destruction of Carthage by the Romans, that people succeeded to the dominion of the peninsula, and extensive traces of their work remain observable to this day in the copper mines of the Sierra Morena. Mine timbers, in all likelihood set by Roman workmen nearly or quite two thousand years ago, remain in place, effectually protected from the gnawing tooth of time by the preserving action of copper sulphate, with which the mine waters are strongly charged. Upon the disruption of the Roman Empire, Spain and Portugal fell to the lot of the Visigoths, and, a few centuries later, the Moors conquered the southern half of the peninsula, remaining in possession for some seven centuries, and operating the Huelvan copper mines to some extent. Upon the expusion of the Moors by Ferdinand and Isabella, late in the Fifteenth Century, the Spanish gained possession of the

rich mines of the Sierra Morena, and the larger of these old properties were worked, in a spasmodic way, with frequent hiatuses, until 1860, when the Tharsis mine—supposedly the Tarsish of the ancients—was reopened, and worked along modern lines. The Rio Tinto, much the greatest of Spanish mines, and one of the four greatest copper mines in the world, passed into the hands of the present owners in 1873, and was reopened in 1876. Further particulars of interest in this connection will be found in the article descriptive of the Rio Tinto mine.

Spain ranks third among the copper producing countries of the world, and was second only to the United States as recently as 1902, having been passed by Mexico in 1903. As recently as the early years of the ninth decade of the Nineteenth Century, the production of copper by Spain, Chile and the United States was practically on a parity. There is no other copper field in the world that has been worked, practically continuously, for three thousand years, notwithstanding which the outlook for the Spanish copper mining industry is excellent.

In the kingdom of Spain there are copper mines of more or less importance in the provinces of Almería, Asturias, Barcelona, Burgos, Cúidad Real, Córdoba, Coruña, Gerona, Granada, Huelva, Huesca, Jaen, León, Madrid, Menorca, Navarra, Palencia, Santander, Sevilla, Teruel and Zaragoza.

In 1901 the official Spanish returns gave 271 productive copper mines in the province of Huelva, but in many cases these counted separately numerous mine openings held by a single company, hence the number of actual producers was much smaller, including only about a dozen with outputs of importance. The active portion of Huelvan cupriferous belt is a zone of about 15 miles average width, with an extreme length of about 80 miles, running practically east and west through the entire province of Huelva, with its eastern end in the province of Sevilla and its western extension in the provinces of Alemtejo and Algarve in the kingdom of Portugal. This district lies along the Sierra Morena, and, in addition to the dimensions before given, which are those of the fairly proven copper territory, there are indications of copper, of more or less promise, is a district of about 30 miles extreme width by 125 miles or more in length, along this range of mountains and beyond its limits. The Sierra Morena, or Andevallo, cupriferous belt, is divided into four zones, the eastern, known as the Cerro Muriano, including various mines near the city of Sevilla, while the western zone lies in Portugal, with the village of Grandola as an approximate center. The northern zone includes the principal mines of Huelva and Alemtejo, while the southern zone includes a number of mines of considerable importance, the largest being the Tharsis. All of these zones present the same general characteristics, carrying lenticular masses of ore, usually at the junction of slates of the lower Carboniferous system with intrusive syenife and diabase. The ore bodies lie parallel with the slate, with northwesterly strike, and dip to the north. The slates are of a yellowish cast at surface, where weathered, but are bluish at slight depth. Apparently the ore bodies, while occurring as immense lenses, may be considered true contact veins. The deposits are of varying size, sometimes of immense proportions, the largest, owned by the Rio Tinto, reaching a length of nearly 4,000 feet, with an extreme width of 500 feet. The ore bodies have, or once had, iron cappings, and the richer ores above ranged about

5 per cent. in copper tenor, being succeeded, at a depth of about 200 feet, by a sulphide zone carrying an intimate mixture of chalcocite and pyrite, with values averaging 3 to 4 per cent. in copper, with some ore of high grade. The decrease in values is fairly steady from the top of the deposits below the altered zone, and at a depth of about 500 feet values range only about 1.5 to 2 per cent. copper, and at still greater depth the copper tenor declines to about one per cent. with indications that the bottom of the immense lenses will carry less than one per cent. copper, though probably they will remain workable, owing to the sulphur values in the pyrite. All ores are slightly argentiferous and auriferous, the precious metals being extracted closely, and while the amount per ton in gold and silver is very small, the aggregate values so saved are very great, owing to the immense tonnage of ore that is treated.

The mines of Sevilla probably rank next to those of Huelva in present importance and future promise, though the production is trivial as compared with the immense Huelvan output. In 1903 there were 23 productive copper mines in Sevilla, which yielded only 2,204 metric tons of copper ore but production has increased largely since.

In 1902 the province of Gerona had 25 mines of copper and 4 mines carrying copper in connection with other metals, all of which were idle.

In the Guadix district, about 15 miles from the city of Granada, in the province of that name, rich copper sulphides are found in a bed of marl, on which some mining has been done.

The province of Huesca has old copper mines and other mines carrying considerable copper values, but copper mining is practically non-existent.

In 1902 there were 41 copper mines, all idle, in the province of Lerida.

The northern part of the island of Menorca shows a copper belt of 16 to 18 miles length, with ore occurring in a bed of marl of one to two feet thickness, lying in clay-shales and sandstones of the lower Triassic system. The Puebla mine shows ore under peculiar circumstances, mainly as chalcocite and chalcopyrite in connection with lignite, the conclusion being inevitable that the copper values were precipitated by the carbonaceous material.

There are copper deposits and attempts at copper mines in the province of Teruel, and the same may be said of the province of Zaragosa. There also are old mines of small importance, now idle, in a considerable number of other Spanish provinces.

SWEDEN. The famous copper mines of Falun have been producing copper for more than 600 years. Copper mines are found in the läns of Dalarne, Östergothland, Kopparberg, Malmöhus, Norbotten, Orebro and Vestmanland. The copper production of Sweden was about 850 long tons in 1799, and 100 years later was only about one-half as much.

The famous mines of Falun are worked by what probably is the oldest stock company now existing, its charter dating from A. D. 1288. The Stora Kopparberg is the best known mine of the district, and furnishes much of the copper and practically all of the gold produced in Sweden. The ore deposits resemble those of the Rio Tinto, and carry 2 to 3 grams gold per ton, occasionally with much higher gold values. The ore is chalcopyrite, disseminated in pyrite, and is divided, as mined, into two classes, known respectively as hard pyrites, carrying about 3.5 per cent. copper, and soft

pyrites, carrying about one per cent. copper only. The sulphur values are of considerable importance in these ores.

SWITZERLAND. Copper ores, mainly bornite, occur in a conglomerate stratum of Permian age near Murtschenalpe, in the canton of Glarus, but apparently no mining ever has been attempted.

TURKEY. Extensive copper deposits are noted at several points in the Balkan Mountains. The present copper production of the Turkish Empire, including holdings in both Europe and Asia, probably is about 3,000 metric tons yearly, with exports of 1,000 to 2,000 tons, the principal mines and production being in Asiatic Turkey. In European Turkey there are copper mines along the southern part, and there is a copper mine at Yardimli, in the Rhodope Mountains. Copper mines belonging to the crown are found in the island of Thasos, and an island in the Sea of Marmora shows copper sulphides, with evidences of extensive mining operations in the past.

WALES. The copper mines of Anglesea were worked by the Romans, and possibly by the Phoenicians before them. Up to about 1830 Wales was a considerable producer, and, in 1799, made about 1,900 long tons of fine copper, rendering this the second copper producing district of the world, but in 1899 the production was only 49 tons, nearly all secured from leaching the mine-waters from old properties.

The Mona and Parys mines of Anglesea, among the most ancient in the world, show sulphide ores with quartz gangue in contact veins of 5 to 60 feet width, between Silurian slate and felsite, copper occurring also as impregnations in felsite.

In addition to the mines of Anglesea there are old copper mines, now idle, in the counties of Caernarvon, Cardigan and Merioneth.

CHAPTER XX.

Copper Deposits of Africa.

The copper deposits of the various countries, colonies, districts and spheres of influence in Africa are treated in detail in this chapter.

ABYSSINIA. Copper deposits exist at various points, but details are indefinite. Abyssinia is a mountainous country, lacking both railroads and good wagon-roads, and the development of mines, especially of copper, is apt to await better transportation facilities.

ALGERIA. The production of Algeria in 1906 was only 440 tons of copper ore, from copper mines in the departments of Alger and Constantine. The argentiferous gray copper ore of Kabylia occurs in rocks of Jurassic age. The Aïn-Barbar mine, in the department of Constantine, near the Tunisian frontier, has a rather remarkable lense of sulphide ore, absolutely isolated and enclosed in Ligurian schist, ore being chalcopyrite associated with galena and sphalerite, and claimed to average 8 to 15 per cent. copper, which obviously is much too high. Along the Mediterranean coast, in the same department, are found a number of small deposits, apparently gash-veins, carrying sulphide ores with quartz gangue. Near Aïn-Sefra an ore body claimed to show 600,000 tons of copper ore was discovered in 1904. In the department of Alger there are several idle mines of argentiferous antimonial copper ores.

ANGOLA. This Portuguese province, in western Africa, shows copper deposits at several points. At Senza do Itombe, 12 miles from the Cuanza river, and near a railroad, there is a conglomerate carrying ores that are oxidized above, with chalcocite, associated with galena, occurring at depth. There also is a mine at Bembe, said to average 12 per cent. in copper tenor, but this has poor transportation facilities, and has not proven a success in operation.

ASHANTI. The occurrence of native copper, apparently in dendritic forms, in a district several days' journey back from Sekondi, on the Ivory Coast, was reported in 1902.

BASUTOLAND. This district, while attached to Cape Colony, is managed directly by the British crown. Strong copper indications are shown at various points, but white settlement is forbidden, precluding all development of minerals.

BRITISH CENTRAL AFRICA. This protectorate shows a cupriferous belt of roughly 25 miles width by 175 miles length, between the Zambesi and Congo rivers, and a little crude mining and smelting of oxidized ores has been done by natives.

CAPE COLONY. Though copper exists elsewhere, the developed mines of the Colony of the Cape of Good Hope are exclusively in Little Namaqualand, on the western coast, in the vicinity of Okiep and Wittwater, all exports and imports being made through Port Nolloth. Attempts at mining in this district were made by Governor Van der Snell, near Spring-

bokfontein, in the Concordia district, as early as A. D. 1685, and these attempts were repeated in 1799, but the first shipment, of eleven tons of ore, was not made until August 31, 1852, since which time production has been continuous. The ore occurs in lenses, often of great size, in granitic rocks. The predominant rocks are gneiss and schist, with a generally east and west trend, and flat dip to the north, traversed by series of fractures, with diorite dykes, in which occur lenses of sulphide ore, mainly chalcopyrite, but with an appreciable percentage of bornite, with dioritic gangue. The principal ore bodies occur at or near the point of intersection of the diorite dykes with barren fissures. The ores range from 7 to 21 per cent. in copper tenor, after careful selection.

CONGO FREE STATE. The principal copper deposits of Congo Free State, as now known, are in Katanga, the southeastern province, around the headwaters of the principal affluents of the Congo river. Principal mining operations of the present are between the Lualaba and Lufira rivers, where a considerable area shows oxidized and sulphide ores, occurring in blanket veins, impregnations and stockwerks, mainly in talcose and silicious schists. These ore bodies are of unusual size, and are said to be of unusual richness, averaging 15 per cent. copper, but apparently this reference is to the enriched ores of the upper workings, and such values are not likely to hold to great depth. There are considerable remains of native workings, and a limited production is secured by natives. More than eighty old workings are shown in one district, where the oxidized ores are smelted in pits, with charcoal, and the product is used for ornaments, buttons and various utensils. This district is of considerable promise.

EGYPT. There are copper deposits in the Nubian region of the Upper Nile, but no attempts at serious mining have been made in historic times.

FRENCH CONGO. Malachite and chalcocite have been found in place in Triassic sandstone, in the Crystal Mountain range, near the coast of Gaboon. Near Comba, between Brazzaville and Loudima, along the line of the Congo Free State, there is a cupriferous district in the Kouilou-Niari basin, ore occurring in cupriferous sandstone above limestone. These deposits have been worked by natives in a primitive way, for centuries, and a considerable trade once existed in copper manufactured from these mines, but this became extinct with French occupation. The native workings are pits and trenches not exceeding about 35 feet in depth, and show azurite, malachite, chalcocite and tetrahedrite. The deposits apparently are of low average tenor, but cover a considerable area. This district has been but slightly explored by Europeans, though some work has been done at the Mindouli mine, which seems the principal deposit. The district is about 300 kilometers from the coast, and probably copper mines would not be workable without railroad transportation, now lacking.

GERMAN EAST AFRICA. Copper ores exist at various points in this protectorate, but no mines have been developed.

GERMAN SOUTHWEST AFRICA. This protectorate has copper deposits in Damaraland, Ovamboland and Hereroland, the latter containing the notable Otavi mines. The copper mines of the Otavi Mountains were worked to slight depth, in a primitive manner, by the natives, apparently for some hundreds of years. A great block fault, in limestone, traversed

by numerous cross-faults, producing diverse deposits, shows ore occurring mainly in sandstone, laid down in sink-holes. This district includes Otavi, on the southern side of the range, and Tsumeb on the northern side. The mine shows native workings, deepest about 35 feet only, over an area of about 200 by 500 feet, with irregular fault veins, carrying mainly chalcocite, with occasional malachite, associated with galena, in masses ranging from microscopic size to two tons in weight, with sandstone gangue, and impregnations in both walls.

In Damaraland there is copper in the Rehoboth district and on Gross and Kleinen Spitzkopf, 20 kilometers northeast of Rehoboth. The ores, as developed, are mainly malachite and chalcocite, with quartz gangue. From the Otyizongati district, about 40 miles east of Okahandja, 100 tons of carefully selected ore sent to Germany in 1904 gave returns of 28.5 per cent. copper.

LIBERIA. Copper ore is said to exist in the interior of this country, but the extremely dense forest growth operates to prevent the acquisition of definite knowledge. Copper has been used to a limited extent, in the making of weapons, by the Mandingoes, a tribe in the far interior. The law prohibits the holding of land by other than Liberian citizens, and until this law is repealed, modified or evaded, there can be no copper production of importance from Liberia.

MADAGASCAR. Copper ores have been smelted by natives, in a primitive way, and to a limited extent, for generations. There are small native mines at Ambataofaugehana in the district of Ambositra, and at Vohinana. The ore is mainly malachite, surface workings giving returns of 10 to 45 per cent. copper. Ore is reported to occur in mica schists, and the mines are said to be nearly worked out. Native mines are reported also from the Betafo country, and in the district of Imerinarive. In the Cercle de Tsiafahy native copper has been found, and virgin metal is reported also from the district of Vonizongo. Rich ores are said to exist near Lake Kinkony, in the Cercle de Mahavavy, and traces of copper are reported from the province of Vohemar.

MOROCCO. Copper ores exist at a number of points in this country, and about 1860 were mined and smelted, in a small way, near Tarudant, capital of the province of Sus. There are occurrences of copper ore near Tangier, also at Tablah, near Mequinez, and at Mesfiwa, in the vicinity of Mogador.

NATAL. There are a number of known occurrences of copper ore in Natal, but the colony lacks producing mines. In Zululand sulphide and silicate copper ores are noted near the Insuzi and Umhlatuzi rivers, in the N'kandhla district, but these lack adequate transport. A syndicate was formed, in 1905, to exploit copper deposits on the Buffels River, along the border of Natal and Zululand. Various local syndicates have done more or less exploratory work at Undweni and vicinity, near the Vryheid border, in Zululand, where a vein, said to be traceable for several miles, shows rich carbonate, silicate and sulphide ores, usually zinciferous, occurring largely as impregnations, but with erratic distribution. The Dania and Magdalen properties, in this district, show fine samples of copper ores.

PORTUGUESE EAST AFRICA. This colony has copper ores in M zambique, Nyassaland and Zambesia, the latter district showing cons able traces of old mining operations, apparently conducted mainly for g but copper ore exists at numerous points, and apparently in prom quantities.

RHODESIA. There are remains of ancient mining operations, both gold and copper, in the colony of Rhodesia, and it is evident that ancients possessed small and crude furnaces for smelting. The m laws of Rhodesia are very liberal, and the harnessing of the Victoria of the Zambesi river should greatly stimulate mining and other indus through furnishing the first cheap power known in Rhodesia.

Copper ores have been found at a number of points, but prin developments are in the northeastern section, in the Victoria dis mainly along the northern reaches of the Kafue river, an affluent of Zambesi. The cupriferous zone is a limestone belt, lying approxima east and west, with a width of about six miles and length of about sixt miles, bounded mainly by Cambrian and Silurian schists, carrying depo with shallow surface zones of oxidized ores, succeeded at little depth sulphides, these deposits occurring occasionally as pipe veins, and bei more or less argentiferous. The Lomagunda district of Mashonaland, ab ninety miles northwest of Salisbury, shows copper impregnations in sili cious and calcareous schists, ores being mainly malachite, with some chry ocolla. The Blue Jacket mine shows old workings to a depth of 100 fee with lateral workings of 10 to 400 feet in length, on ore bodies occurrin in limestone and schists. Apparently these mines were worked to th depth of the oxidized ores, the ancient miners stopping when base ores wer reached. It is obvious from the depth and extent of these workings, an the remains of crude smelters, that the work was done by some race muc further advanced in civilization than the present natives.

SENEGAL. The existence of copper ores has been reported fro various points along the Senegal river, but no mines have been develope

SUDAN. Prospecting has been done in various parts of the Angl Egyptian Sudan, but nothing of importance found, though there is b lieved to be copper in the Suakin district. The only producing copper mi is the Hofret-el-Nahas, in southwest Kordofan, where mining and smel ing are conducted on a primitive scale, to secure copper used for pres local consumption.

TRANSVAAL. Apparently copper was worked to some extent by th ancients, and there are numerous remains of prehistoric diggings, esp cially near the Messina mines, in the Zoutpansberg district of northe Transvaal. There has been considerable activity in copper developmen and even greater activity in the formation of small local mining syndicate since 1905. Copper ores occur in the districts of Lydenburg, Middelbur Potchefstroom, Pretoria, Rustenburg, Waterburg, Zeerust and Zoutpan berg.

The most promising copper developments are noted at the Messi mines, near the Limpopo river, in the Zoutpansberg district, and there a numerous smaller developments, on which a little work has been done, this district. Work is under way at Barberton and vicinity, in the Middl

burg district, and there is a copper belt, on which a number of explorations are being made, near the Olifants River, about 45 miles northeast of Pretoria. Some of the copper prospects of the Transvaal are of promise.

TUNIS. Copper ore exists at various points in Tunis, occurring mainly as oxidized ores in small bodies, and tetrahedrite, frequently rich in silver, these ores being found mainly in limestone, with ochrous iron gangue. Mines have been worked at Chouichia for some time, the production, which is small, being shipped to Europe, as a matte of 35 to 50 per cent. copper tenor. On the little island of Galita, off the northern coast of Tunis, a small mine has been opened on a vein of about 3 feet width, traversing diorite. The ore is mainly chalcopyrite, averaging about 5 per cent. copper and the vein is traceable for several hundred meters. There are several parallel veins, one of which, slightly developed, shows carbonate ores giving average assays of about 12 per cent. copper.

UGANDA. The British protectorate of Uganda, in Central Africa, near Lake Tanganyika, has copper ores in the Central Province, but apparently no serious attempt has been made at development, transportation facilities being poor.

CHAPTER XXI.

Copper Deposits of Asia.

The copper deposits of Asia are treated herein, by countries, in alphabetical order, as in the preceding chapters.

AFGHANISTAN. The northern part of Afghanistan is said to be rich in copper, and in this section there are small local mines, worked by old methods for some centuries. The copper deposits are considered valuable but the government refuses to grant either railroad or mining concessions to foreigners, and will not allow a white man to take up permanent residence in the country, hence until the present policy is changed there can be no copper developments of importance.

ANNAM. Copper ores are known to occur at various points in the province of Quang-Nam, but nothing has been done in the way of modern mining.

ARABIA. The ancient Egyptians mined both copper and turquoise at Maghara, in the Sinaï Peninsula, and it is evident, from old inscriptions, that copper was smelted at that point in both the Fourth and Twelfth Dynasties. These mines evidently never were rich in metal, but probably were among the very first copper mines ever opened, and the date of the first mining probably is as remote as 5000 B. C. These mines were the cause of various wars between the races coveting them, but were held mainly by the Egyptians, for several thousands of years. It seems probable that after being worked, more or less steadily, for about three thousand years, they were abandoned finally, before Moses led the children of Israel out of Egypt, and about a thousand years before the opening of the Rio Tinto mine which occurred circa 1,000 B. C. An attempt at reopening some of these ancient mines was made, early in the Twentieth Century, after about four thousand years of idleness. The ore is mainly chrysocolla, associated with turquoise, in porphyry, and there are remains of ancient furnaces and old slag-piles near the adits. Analyses of the slags do not show the use of fluxes in the reduction of the ores, and it is probable that they were smelted with charcoal, in small brick kilns. There are deposits of copper ore at other points in Arabia Petrea, lying along the shores of the Red Sea.

BURMAH. The discovery of a body of promising copper ore was reported from Mimbu, in 1906, and several copper mines are being opened in the Upper Shan states.

CHINA. Copper ores occur in more or less profusion at a considerable number of points in the vast Chinese empire, and copper mines have been worked in several provinces, notably in Yun-Nan, certainly for many centuries, and probably for several thousand years, remaining active to this day, the ores being mined and smelted in a primitive manner. The production of the empire is estimated at five million pounds yearly, all of which is required for domestic consumption, in addition to heavy imports.

Owing to the existence of vast coal measures of prime quality, and a large and steady supply of efficient and tractable labor, the development of copper mining and smelting, when once begun in earnest, along modern lines, should be rapid, and China should become, during the second or third decade of the Twentieth Century, an important producer of the metal.

A few mines, operated in a primitive manner, with correspondingly small production, are found at San-Kia-Tschang, in the province of Ho-Nan.

In the province of Hupeh, near Ichang, there are large beds of cupriferous shale, containing disseminated ores of low average tenor.

There are deposits of copper ore at various points in the province of Kwang-Si, with a few small mines developed along primitive lines.

There are copper mines in the province of Kwei-Chau, in southern China, of considerable antiquity, as evidenced by extensive slags resulting from old smelting operations. The ore bodies of Kwei-Chau resemble those of Yun-Nan.

The mountains of Manchuria contain promising deposits of copper, at several points, and some of these have been worked by natives, in a small way, along very crude lines. The most modern mining and smelting plant in the Chinese empire is found near Kaya, this having been installed early in the Twentieth Century.

Copper deposits and small copper mines are found at several points in the province of Shan-Tung, and this province is believed to be rich in minerals.

A limited copper production is secured from a few small and ancient mines in the province of Sze-Chuan, where the metal is extracted mainly from low grade cupriferous sandstones.

The province of Yun-Nan has the principal copper mines of China, and furnishes the moiety of Chinese copper production, the annual ouput of the mines of Yun-Nan being estimated at one to two thousand tons of fine copper. The copper mines of northeastern Yun-Nan have been exploited for many centuries, and in the aggregate their production is by no means trivial. The ores are mainly sulphide, and are slightly auriferous and argentiferous. The principal centre of copper mining and smelting is at Tung-Chau.

FEDERATED MALAY STATES. In this British protectorate there are copper deposits, some apparently of promise, at several points, but these remain undeveloped, mining efforts having been centered upon tin.

FORMOSA. Copper ores exist at various points on this island, now held by Japan. In the Kinkwaseki gold mines, in the Keelung district, copper ores have been discovered, and their exploitation was begun in 1906.

INDIA. The beginnings of the copper industry of India antedate reliable historical records, but it is known that copper ores have been mined and smelted for a score or more of centuries. India was a considerable producer of copper during the middle ages, and up to about the middle of the Eighteenth Century, after which the output fell off slowly, and has dwindled to merely trivial figures. During the first half of the Eighteenth Century India shipped large quantities of copper to Europe, but in the latter half of that century the current was reversed, and the Indian imports of

copper for 1901 were 7,998 long tons, and at present must range in the neighborhood of 10,000 long tons yearly.

In Bengal there are old copper mines at various points. The last active mining was done from 1887 to 1891, at Baragunda, Hazaribagh, but proved unprofitable, all ore being carted 24 miles to a smelter at Giridhi. The ore occurs as chalcopyrite running 1 to 3 per cent. copper, with gangue of country rock, in mica schist. A single small pocket of ore discovered in the Singhboon district produced a small quantity of 13.5 per cent. ore in 1892, but additional pockets were not found. The Chota Nagpur mines, approximately 150 miles from Calcutta, are in about the center of a cupriferous belt of about 75 miles length, showing numerous old workings, and paralleled by a railway. The extensive remains of former work evidence considerable activity, and a respectable production, at some time in the past.

Copper ore exists at various points in the Central Provinces, and a mine is being developed near Sleeminabad, 40 miles from Jubbulpore, in a formation of Silurian age showing dolomite, slate, quartzite and mica schist, folded and metamorphosed, with numerous porphyritic dykes, ore occurring in the stratified rocks near the intrusive porphyries. The veins, having well defined walls and average width of about 6 feet, have been traced by outcrops for nearly two miles. The ores are auriferous and argentiferous malachite and argentiferous tetrahedrite, giving assays up to 25 per cent. copper, 197 oz. silver and 15 dwts. gold per long ton. In 1901 twenty-five long tons of ore were mined in Rajputana, where chalcopyrite occurs disseminated through black Paleozoic slates. These deposits have been worked in a very small way for centuries.

In the Northwest Provinces copper ores of some promise are found in the Kumaon division, lying in the Himalayan region between Nepal and the Punjab, the Rai mine being the principal property. The ores of the Rai district occur in fissure veins showing gossan cappings, with the usual oxidized and sulphide ores, with quartz gangue, and occur at times as impregnations. Labor is plentiful, cheap and poor, and transportation facilities are inadequate, but the district is considered of some promise. In the division of Garhwal considerable copper mining has been done in the past, at Dhanpur and elsewhere. The Dhanpur deposits occur as bornite and chalcopyrite, in the joints of calcareous clay-slates, and in siliceous limestone, near igneous intrusives, the workable deposits occurring at the intersections of vertical and horizontal bedding and jointing planes, with quartz gangue.

At El Agur there is a stockwerk in quartzite, carrying carbonate ores, chalcopyrite and tetrahedrite, of an estimated average copper tenor of about 5 per cent., the zone being traceable for nearly fifty miles, and being worthy of careful study when adequate transportation facilities are furnished. Small pockets of rich ore have been found at various other points, but the uncertainty of these has not permitted continuously profitable mining.

JAPAN. Copper was discovered in Japan about the beginning of the Seventh Century, and until well toward the close of the Nineteenth Century, mining and smelting were done along primitive lines, the ore being reduced in clay pits, with charcoal for fuel. The first exports, other than

to China, were made in the Seventeenth Century, when the Dutch, who had a monopoly of Japanese foreign trade, exported seven hundred to twelve hundred tons of copper yearly for many years. In 1799 Japanese mines made about 2,800 long tons of fine copper, and in 1899 produced 27,560 tons, a tenfold increase, and the early years of the Twentieth Century have seen a steady gain in production. The modernization of mining and smelting methods was begun in the ninth decade of the last century, but beginning with the tenth decade progress was rapid, and all of the principal mines of the empire now have mining and smelting equipments of a most modern sort, and are managed with as great a degree of technical skill as can be found in any mining field of the world. Several of the largest copper mining companies of Japan have made a regular practice, for ten years or more, of sending their chiefs of departments around the world in search of information, and the benefits of such an unusually wide-awake policy are reflected in the increased outputs and greater profits of the best Japanese copper mines. Foreigners or foreign corporations cannot hold title to Japanese mines, but foreigners can become interested, as partners, with Japanese subjects, in mining properties. The mining industry, however, to all practical purposes, is exclusively in the hands of the Japanese, and likely to remain so.

Copper is much the most important metallic resource of Japan, and this country now holds fourth place among the copper producing countries of the world. The local consumption was about three thousand tons in 1899, and probably was about seven thousand long tons in 1906. Fully three-fourths of the copper produced is exported, this forming an important commercial resource of the empire.

Copper ores are widely spread, occurring on all of the principal islands, and showing nearly every variety of type. There are copper mines of importance in the provinces of Awa, Bingo, Bitchu, Bizen, Hida, Higo, Hyuga, Iwami, Iyo, Izumo, Kaga, Mimasaka, Mino, Nagato Rikuchu, Shimotsuke, Tosa, Ugo and Uzen. There are nearly two hundred copper mines, or mines in which copper is a factor of importance, of which about forty are mines making annual products of one hundred thousand to fifteen million pounds each, fifteen of the number exceeding an average annual production of one million pounds each, three of these making about half of the copper production of the empire. Ores are almost exclusively sulphides, though limited quantities of oxidized ores are noted, with occasional native copper.

The Ashio mine, in the province of Shimotsuke, is the largest copper mine of Japan. The veins are of wonderful profusion, being hundreds in number, of which about thirty are worked, these veins occurring as synclines, being opposed, in pairs, the seven main veins averaging 6 to 7 feet in width. A little melaconite and bornite are carried in the upper levels, but the principal values are in chalcopyrite, associated with galena, sphalerite, arsenopyrite and pyrite, with clay gouge and quartz gangue.

The Kosaka mine, in the province of Rikuchu, is in the extreme northern end of the main island of Japan. This was an old silver mine, supposedly exhausted, but now is the second largest copper mine of Japan, with prospects of becoming first. The ore is chalcopyrite, associated with sphalerite and pyrite, impregnating and cementing a volcanic tuff. The

ore bodies, five in number are of enormous size, the largest being 100 to 600 feet in thickness, of one-half mile known length, and proven by drill-holes to a depth of 1,700 feet.

The Besshi is a famous mine in the province of Iyo, island of Shikoku. The ore body is a vein of 4 to 30 feet width, with an average of 20 feet, developed for a length of about 6,000 feet, and occurs in alternating layers of chloritic and graphitic schist, each enveloped by a quartz schist known locally as "habu," with interstratification of piedmontite schist. Step-faults run nearly parallel, from east to west, giving throws of 10 to 20 feet, with occasional throws up to 60 feet. The ore is chalcopyrite, disseminated in pyrite, averaging about 4.5 per cent. copper.

Further details of the geography and geology of Japanese ore deposits are given in the detailed descriptions of the various mines.

KOREA. Copper ores are noted at a number of points in the northern and southern parts of the Korean peninsula, but have been found only rarely in the central part. Copper had been mined by natives for some centuries, the product being utilized in the making of household utensils. By Korean law mineral deposits are the property of the crown, hence it is altogether probable that mines will be developed mainly by the Japanese. The production of copper in 1903 was estimated at 280 tons.

The Kap San mine, in the province of Hamgyeng, is the principal property, and is under development by the Japanese firm of Mitsui & Co. Another property of some promise is the Chhyang-Uön mine, about one ri north of Chhyang-Uön, which was opened about 1885 by the Korean throne, and was transferred to Japanese control in 1893, and worked until 1905, when the rich ores were exhausted and the mine closed down. There also are old mines, opened early in the Nineteenth Century, but worked until 1904, at Hu-Chhyang and Sin-Työn.

PERSIA. The empire of Persia is known to be rich in copper, and there are small mines, many of them very old, from which copper ores are mined and smelted, in an exceedingly crude way, the small production being sufficient merely for the limited domestic demand. Until there are better transportation facilities, and foreign capital is enlisted, the copper mines of Persia are not likely to become producers of international importance.

There are primitive copper mines south of Kerman, but these lack facilities for economical transport. At Seman the deposits consist of disseminations and veinlets of oxidized ore in clay-slate, with an estimated average tenor of about 3 per cent. copper. There also are small copper mines at Sabzwar and in the Turbat district, worked on primitive lines.

SIAM. Copper ores were worked at several points by natives until the early years of the reign of the predecessor of King Chulalongkorn, but there is no present production, though copper deposits of more or less promise are found at a number of points, notably in the mountain ranges along the valley of the Menam river. Outcrops of copper ore are noted frequently along the railroad line leading to Korat, with rather extensive remains of ancient workings, where a little prospecting was done, and some ore found, by a Danish syndicate, circa 1901.

SIBERIA. The extent of Siberia is so great, the lack of transportation facilities so utter, except in a narrow stretch along the Trans-Siberian railroad, and the country is so thinly populated and so new, with the attendant lack of capital, found in all new countries, that it is scarcely to be wondered at that only a beginning has been made in the development of the undeniably extensive and valuable copper measures. The principal copper mines are found in the governments of Semipalatinsk and Akmolinsk. There are two small producers in the Russian Altai, and other small producers nearer the city of Semipalatinsk, the largest making about two million pounds of copper yearly. The output of the Altai mines, in 1903, was only 228 long tons of fine copper.

In the government of Akmolinsk, in the Kirghiz Steppe, there is one highly promising mine, known as the Spassky or Yuspenssky, where considerable production has been secured in the past, along very crude and wasteful lines. This property is now in the hands of an Anglo-French company, but is hampered by lack of rail transport. There are other properties of promise in the government of Akmolinsk.

In the government of Krasnojarsk, in central Siberia, next east of Semipalatinsk, there are copper deposits, apparently large and promising, extending from near the line of the Trans-Siberian railroad to the Altai Mountains.

There are copper deposits of uncertain size and tenor in the vicinity of the city of Tomsk, in the province of that name, lying next north of Semipalatinsk, and to the northward of the Trans-Siberian railroad.

In the Trans-Baikal province, east of Lake Baikal, there are several copper deposits said to be of considerable promise. One of these is in the basin of the Chida river, where native copper occurs in masses ranging up to several pounds in weight, in amygdaloidal melaphyrs, under conditions somewhat similar to the occurrence of native copper in the Lake Superior district.

There are copper deposits, considered promising, in the northern province of Yeniseisk, and it is probable that copper ores exist also in the province of Irkutsk, and very likely in practically all of the other Siberian provinces.

THIBET. Copper is mined and worked in a small way and a primitive manner in southeastern Thibet, but the extent and promise of the copper measures are undetermined.

TONQUIN. Copper mines are found in the provinces of Son-Tay, Lang-Son and Lao-Kay, near the frontier of the Chinese province of Yun-Nan, and, like the mines of Yun-Nan, these have been worked in a primitive way for centuries, but never have become as important as those across the Chinese border. Various concessions have been granted for the exploration of copper deposits in Tonquin, but no producing mines have resulted therefrom as yet.

TURKESTAN. There are a number of small copper mines in Turkestan, the largest being the Karankuski, near Tashkent, and since the occupation of Turkestan by Russia there has been renewed interest in mining operations. A small smelter was built in 1903, on the shore of the Syr Daria river, at the foot of the Supetau Mountains, and new copper mines

are being opened along the Syr Daria river in the Namangan and Khokand districts. There also are ores in the Ferghanah district, occurring as impregnations in sandstone to the extent of 1 to 5 per cent. copper, with occasional local enrichments up to 10 per cent. and as high as 40 per cent. in copper tenor.

TURKEY. The principal copper mines and the most promising copper deposits of the Turkish empire occur in Asia. The best known mines are those of Arghana-Maaden, located between Diarbekir and Kharput, in the Armenian Tauros of Asia Minor. At the beginning of the century these mines were producing about 1,500 tons of fine copper yearly, exported mainly to England via Alexandria. The ore is of high grade, though mining and smelting methods are by no means modern. Copper ores occur also in several of the cazas in the Vilayet of Cosova. There are mines of importance in the vicinity of Bakir-Maaden, near Diarbekir, and formerly there were mines in operation near Tokat. Copper has been produced to greater or less extent by the mines of Kalabak, near Mount Ida, from time immemorial, these having been old mines in the time of Strabo, who described them. The ore of the Mount Ida mines is chalcopyrite, occurring in Tertiary slates and limestones. There also are small old mines near Dendengatsch.

In the Vilayet of Trebizond, between Kerassund and the Russian frontier, along the Black Sea, there is a copper district of some promise, with a number of small producers, and copper mines are said to have been worked in this district as early as the beginning of the Thirteenth Century.

CHAPTER XXII.

COPPER DEPOSITS OF AUSTRALIA.

The copper deposits of the Commonwealth of Australia, which includes the island of Tasmania, are treated in alphabetical order, by states, in this chapter, and those of New Zealand follow. Copper production dates from 1843, when the first shipment was made from the Kapunda mine, opened in the previous year. Production in 1906, by states, was by Tasmania, South Australia, Queensland, New South Wales and Western Australia, in the order given, Victoria not being a producer. Development has been hampered, except along the coast and in specially favored interior districts, by lack of transportation facilities, lack of water and lack of the large capital necessary to make successes of mines of low and medium grade copper tenor.

NEW SOUTH WALES. Copper was the first metallic product of this state, the first mining attempts having been made in 1845, but the Great Cobar mine, opened in 1869, was the first important producer and remains much the largest mine of the state.

There are nearly 300 localities in the state where copper has been found, and in most of these mines have been opened or attempts made at mining. There are three principal copper districts, known as the Cobar, Coast and Central fields. Copper is found mainly in the counties of Bathurst, Blaxland, Canbelego, Cunningham, Mouramba, Murray and Robinson. The principal cupriferous field is in Robinson and adjoining counties, in the western districts, where copper deposits of more or less promise are shown over an area of about 400 square miles. This field includes the Cobar, Girilambone, Nymagee, Melrose, Mount Hope and smaller cupriferous districts. The formation over this entire territory is mainly Silurian slates, with few occurrences of eruptive rocks, ore bodies occurring as bedded veins in Silurian schists. The district is a desert plateau, with occasional hills and short mountain ranges. There is a cupriferous district in the central part of the state where eruptive rocks predominate, and there are a number of scattered mines along the coast. The Budgery district is one of the newest fields of promise.

QUEENSLAND. The copper deposits of Queensland probably are the most promising found in any of the Australian states, but the industry suffers, not only from the aridity of many of the principal districts, and lack of railroads in certain of the fields, but also from untoward political conditions, there being universal suffrage, with the labor element in the saddle and inclined to captious and arbitrary methods. The state was a regular though small producer of copper until the collapse of the Secretan Syndicate in 1889, after which the industry was greatly depressed until about 1898, since which year there has been marked and fairly steady progress. The older copper fields were at Peak Downs, Mount Perry and Cloncurry, native copper being mined in the last named district from amygdaloidal traps, under conditions greatly resembling those found in the Lake

Superior district. Work at this point was suspended because of lack of rail transport. There are copper mines in the counties of Beaconsfield, Bowen, Cardwell, Clermont, Cook, Gilbert, Lynd, Merivale and Palmerston, and occurrences of copper minerals at other points.

The Herberton district is the third largest producer of the state and includes the Chillagoe sub-district. This is a field of considerable promise, and was the largest copper producer of the state previous to the development of the copper measures of the Mount Morgan field. The Chillagoe district covers about ninety square miles, with smaller subsidiary districts adjoining. Copper and lead occur in conjunction with garnet and wollastonite, usually at or near the point of contact of Carboniferous limestone with granite-porphyry, the latter being much decomposed. The ore bodies vary greatly as to size and dip, ore occurring mainly as irregular segregations and being very bunchy. The existence of ore deposits without regular walls is a feature typical of this field. The surface ores as a rule are decidedly rich.

The Mount Perry district, in Bowen county, near the coast of southern Queensland, is a field of considerable importance. The predominant rock form is granite, and the fissure veins therein are mineralized only for portions of their width, the rich paystreaks averaging under one foot as a rule. Ore values have disappeared with depth in some cases, but in others have held to at least 800 feet. The ores are highly silicious and the gossans are both auriferous and argentiferous as a rule.

The change at depth of the Mount Morgan mine, in the Mount Morgan field, from a big gold mine to a big copper mine, is referred to in detail in the description of that mine.

The Stanthorpe field is an old district of considerable promise, but is now a small producer only.

The Tenningering district is fourth in the state in point of production, and has several properties of promise.

The Glassford Creek district is a new and promising field, with active development work under way at several properties.

The Cloncurry field, in northern Queensland, shows copper deposits at various points over a district about 75 miles from east to west and about 150 miles from north to south, the center of this district lying about 150 miles south of the Gulf of Carpentaria. The climate is hot and wood supply inadequate, with shortage of water at some points. Ore bodies are numerous and rich, but narrow, though showing good outcrops, and are said by Thos. Gibb to present the appearance of bedded deposits rather than of fissure veins. There also are occasional veins of greater width, but not outcropping so prominently, these carrying a gangue of kaolin, and the slate walls are impregnated with pyritic ore. Indications point to deposits of low grade sulphides at depth, and some of the oxidized ores are considered amenable to cheap leaching processes. Mining and smelting have been hampered by lack of cheap transportation, but a railroad to connect Cloncurry with the port of Townsville, to be in operation about 1908, should greatly stimulate mining and smelting developments.

SOUTH AUSTRALIA. The Kapunda mine was found in 1842, a decade before the discovery of gold, and in 1845 the Burra Burra mine began production, since which time South Australia has been a regular

producer of copper to some extent. The first smelter was built in 1851 at Port Adelaide, and the second at Wallaroo in 1861. There are about 500 mines, or attempts at mines, in South Australia, of which about 25 have been developed to an important extent. The principal mines are in the counties of Adelaide, Burra and Daly, with other mines of less importance in the counties of Flinders, Light and Robe, and in the Northern Territories.

The Wallaroo and Moonta mines, in Daly county, on the Yorke Peninsula, much the most important producers of the state, are old mines, dating from 1863. The country rock is porphyritic and ores are mainly sulphide, though the usual oxidized ores, including a considerable percentage of atacamite, occur in the upper workings, with a barren zone of 50 to 125 feet between the oxidized ores and chalcopyrite.

In the Kapunda district, about 50 miles north of Adelaide, where the first copper discoveries were made, the ores are mainly oxides and carbonates, with an appreciable amount of native copper. In the Burra Burra district, about 125 miles northeast of Adelaide, the predominant rocks are limestone and shale, carrying very irregular deposits of secondary ore, with increased regularity in vein formation noted at considerable depth. The promise offered by various cupriferous fields of this state would seem to justify a much larger copper production than has been secured as yet.

TASMANIA. Copper production on an important scale dates from the opening of the Mount Lyell mine, in 1896, and this remains the only important producer of the state. All of the copper fields under exploration or now producing are in the northwestern corner of the island, in the counties of Montagu, Russell and Wellington.

The Mount Lyell district, in Montagu county, is the only developed field of the state. Rainfall is heavy and the topography of the district is rugged. The principal ore bodies now exploited occur as mammoth lenses of pyritic ore, mainly chalcopyrite, with occasional bornite, disseminated through pyrite, occurring in conglomerate and quartzite, associated with mica schist. A limited amount of chalcocite, and a little native copper, are shown at some properties, but the production is almost exclusively from low-grade disseminated sulphide ores, though one mine is working on native copper.

Considerable prospecting has been done on Mount Darwin and Mount Jukes, adjoining peaks known as the Darwin and Jukes field. In the North Dundas field some prospecting has been done, and considerable ore shown, this being mainly of low grade.

VICTORIA. The principal copper field of this state, so far as can be judged from the very limited amount of work done, is the Beechworth district, where outcrops of ore have been noted at a number of points in an area of about 50 square miles. Total production of copper ore from all the mines of Victoria, to the end of 1905, was only 17,470 long tons, valued at £206,895. Prospecting was resumed, on a small scale, in 1907.

WESTERN AUSTRALIA. Copper ore was discovered in the Northampton district as early as 1842, and the first production was secured in 1855, but no large copper industry has been built up, though a number of small mines, near the coast, were worked in the eighth and ninth decades of the Nineteenth Century. Production has been secured mainly from selected ores, gained by hand-dressing, shipped to distant smelters for

reduction, and, of course, only high grade ores can afford a profit under such circumstances. Production in 1906 was 7,430 long tons of ore, valued at £50,337, and 296 men were employed in the industry that year. A copper smelter erected by the state has been sold to a private company, with the proviso that custom smelting be done for all comers at reasonable rates, and it is possible that the building of this smelter may mark the beginning of a substantial industry, as Western Australia is by no means devoid of copper deposits of promise. The principal copper fields of the state are in the districts of Ashburton, Champion Bay, Mount Margaret, Mount Morgans, Murchison, Northampton, Phillips River and Pilbarra.

The Mount Margaret goldfield of the Mount Morgans district is much the largest producer, having mined 4,361 long tons of ore, valued at £21,934, in 1906, and the smelter now in operation in this district should stimulate development and production.

The Murchison goldfield has several properties of promise, but the production of 1906 was only 133 long tons of ore.

The Phillips River goldfield, in the extreme southern part of the state, was the only copper producer in 1905, and in 1906 shipped 2,885 long tons of selected ore. The principal ores of this district, as mined, are malachite and chalcocite, giving average assays of 31.48 per cent. copper, 2.16 oz. silver and 0.15 oz. gold per long ton.

The Pilbarra goldfield has copper ore deposits of promise, but these have been idle for several years. In the West Pilbarra district the ore occurs in bodies of considerable size, as oxides and carbonates of high grade, in schistose slate adjoining an igneous intrusive.

NEW ZEALAND. Copper was discovered in 1842 on Kawau Island, and copper mines were opened and worked on Kawau and Great Barrier Islands, circa 1865. A copper property at Nelson, opened about 1880, had a smelter, but none of these mines were successful. Ore has been found at Omaunu, in Whangaroa county. The production of copper ore from 1853 to 1904, inclusive, was valued at £18,211. One copper property was under development at last accounts.

CHAPTER XXIII.

Copper Deposits of Oceanica.

The copper deposits of this grand division are treated under the names of the various islands in which they occur, in alphabetical order, no atempt being made to group the holdings of the various great powers.

BORNEO. Copper ores and other minerals are noted at several points in the northern part of the island, but these remain undeveloped.

CELEBES. A Dutch company has done some development work in the Pagoeat district, south of Palehleh, in the northern part of the island, where the ore occurs as sulphide impregnations in slate. In the same general district, about ten miles west of Somalata, on Demerki Bay, a brecciated vein carries about 20 per cent. of slightly auriferous and argentiferous sulphides in the form of chalcopyrite, sphalerite, galena and pyrite.

JAVA. Pospecting work during 1903, in the Poelonz district, near Soerabaia, exposed a large mineral body carrying fair values in auriferous and argentiferous chalcopyrite, sphalerite and galena. The vein is about two meters in average width, opened by several shallow shafts and 223 meters of tunnels, the ores shown assaying from 0.9 to 5.25 per cent. in copper tenor.

In the Gunong Kendeng district there are springs carrying copper iodides in solution, and from these thermal waters crude iodide of copper is secured by evaporation, the production amounting to 2,346 kilograms in 1899.

NEW CALEDONIA. More or less copper production was secured from the mines of New Caledonia during the last quarter of the Nineteenth Century, but the mines have been practically idle since 1902, when the output was 3,721 metric tons of copper ore, the greatest production having been 6,349 metric tons, valued at f492,310, in 1899.

There are copper mines in the districts of Bonde, Diahot and Noumea, in the northern part of the island, ore occurrences being noted in the valleys of Diahot, Nehoue and Koumac. The ore occurs as lenses in talcose and chloritic schists, and as stockwerks, the oxidized ores near surface carrying 2 to 4 grams gold per metric ton, while the sulphide ores, mainly chalcopyrite at depth, give considerable silver, this ranging up to 200 to 400 grams per ton from selected ores.

NEW GUINEA. Copper deposits are being exploited in the Astrolabe Mountain range, on the Laloki River, about 15 miles from Port Moresby, in the British portion of New Guinea. The stratified beds are mainly limestone, with occasional sandstone and shale and a few conglomerate tuffs, with diabase intrusions, the district somewhat resembling the Mount Lyell field of Tasmania. A shipment of 17 tons of selected ore, in 1906, gave returns of 26.8 to 32 per cent. copper, with traces of gold.

PHILIPPINES. Copper ores occur in the islands of Luzon, Mindanao, Mindoro, Masbate and Panay, and their occurrence is reported, though not verified, from the island of Balabac, in the Paragua group. Native copper is said to occur in stream-copper gravels, in addition to lode deposits. Apparently the Philippines contain considerable copper deposits, and are likely to become a producing field of some importance, eventually.

In the island of Luzon there are occurrences of copper ore in the provinces of Batangas, Benguet, Camarines Norte, Lepanto and Tayabas. Many the most important copper measures of the island occur in the province of Lepanto, where natives were mining and smelting copper ores before the Philippines were discovered by Magellan. The Mancayan mines were worked by Igorrotes before the Spanish conquest, and their metallurgy was surprisingly good. The processes of reduction consisted of alternate roasting and matting, with eventual production of ingots of good quality, and the methods presumably were derived from Japanese or Chinese sources. In addition to supplying their own needs, the Igorrotes exported about twenty tons of manufactured copper yearly, leading to an invasion by the Spanish, ending in the organization of the Cantabro-Filipino mining company by which the Spanish and natives joined forces, and two mines were worked extensively from 1864 to 1874, with an average yearly production stated to have been about 1,100 tons, work ending with the death of Don José Matías Santos, an exceptionally able man, who had been in charge of the work. Since 1874 the small production has been secured by natives only, along crude lines, but important development work is under way by several companies, notably one composed of American and English capitalists who plan building a railroad from Mancayan to a seaport on the western side of the island. The Mancayan and Suyoc districts, in the southern part of Lepanto, are but a few miles apart. The Mancayan ores are said to average about 16 per cent. copper, and in the Suyoc district there are several deposits of auriferous tetrahedrite, tennantite and enargite, assaying 9.7 to 32.9 per cent. copper and 85 cents to $4.75 gold, per short ton. Chalcopyrite is known to exist in the Bontoc district. In the province of Batangas copper ores occur in the Loboo Mountains, in veins of 6 inches to 2 feet width, carrying oxidized ores, secondary sulphides and chalcopyrite, all auriferous and argentiferous, with quartz gangue. In the province of Benguet, Luzon, promising copper ores are noted on the Buld River. In the province of Camarines Norte, in the southern part of Luzon, there are occurrences of copper ore apparently worthy of investigation. In the Pangasinan district, at Salasa, 10 miles west of Dagupan, auriferous copper deposits are worked to a very slight extent. Copper ore is reported also from the province of Tayabas, in the island of Luzon.

Samples of native copper have come from the island of Masbate, but attempts at mining seem to have proven unsuccessful.

In the island of Mindanao copper ores are noted in the province of Surigao, and mines have been worked by Moros and Chinese, in a crude way. A German company did some mining, going to the point of building a small smelter, but did not meet with success.

In the island of Mindoro occurrences of copper ore, apparently all chalcopyrite, are reported from various points.

Carbonate ores of good tenor have been secured in the province of Antigue, in the island of Panay.

SOLOMON ISLANDS. In this British protectorate copper is believed to exist on several islands, and some prospecting was done in 1901, and a little ore was found on the island of Rendova, but nothing came of the discovery.

CHAPTER XXIV.

Copper Mines of the World.

As in the three preceding annual editions of this work, the detailed descriptions of copper mines and companies, given in this chapter, are printed in alphabetical order, regardless of location. This plan, while having some obvious disadvantages, is found, upon the whole, the best of any tried or suggested, as it renders the work fully self-indexing. In actual practice the plan is not so easy to enforce as might be assumed, owing to the large number of duplicate names, and for various other reasons. The definite articles have been omitted from all titles in English and German, but could not well be omitted from Spanish and French titles. In cases where the Spanish or French articles are used, the descriptions have been filed upon the name of the mine rather than the article, except that in the case of American or English companies having Spanish titles, the filing has been done upon the article, whether La, Las, Los or El. The plan of indexing followed may seem somewhat cumbersome and awkward, but the difficulties encountered in dealing with titles in a dozen different languages, each with its own individual idioms, have been by no means inconsiderable.

As in previous years, there is a very considerable increase in the number of titles, which have grown from 256, in Volume I, to 4,626 in the present issue. It must not be thought, however, that the supply is nearing exhaustion. Chile alone has about 5,000 copper properties, mainly mere prospects, of very slight importance, only about 100 of which are included in the present edition.

AAMDAL COPPER MINES SYNDICATE, LTD. **NORWAY.**

Property sold and company wound up, circa 1903.

AAMDAL MINE. **NORWAY.**

An old property, at Mo, Bratsbergamt, Norway, which formerly was worked to a considerable extent. Was sold, circa 1903, to the Tharsis Sulphur & Copper Co., Ltd., by the Aamdal Copper Mines Syndicate, Ltd., and was resold, circa 1904, to a Norwegian syndicate. The mine made 240 tons of fine copper in 1895, when last worked as a producer. Development by the Tharsis company is said to have shown a large body of low-grade ore and property is regarded as promising, if worked on a large scale, with a fully modern plant.

zona, with capitalization $1,000,000, shares $2.50 par. Lands, sundry claims, 3 miles from Bisbee, opened by a 30′ shaft, showing ore assaying well in gold and copper. Officers of company enjoy a good local standing.

ADVENTURE CONSOLIDATED COPPER CO. MICHIGAN.

Office: 32 Broadway, New York. Mine office: Greenland, Ontonagon Co., Mich. Isaac H. Meserve, president; James L. Bishop, vice-president; W. R. Todd, secretary and treasurer; preceding officers, Chas. J. Devereaux, James S. Dunstan, Chester E. Weston and Chas. D. Hanchette, directors; W. A. O. Paul, assistant secretary and treasurer; Samuel Brady, superintendent; W. H. Williams, mining captain; Allan M. Eddyvean, mill superintendent; A. H. Sawyer, engineer; S. A. Prince, clerk.

Organized Oct. 17, 1898, under laws of Michigan, with capitalization $2,500,000, shares $25 par; paid in, $20. American Loan & Trust Co., Boston, registrar; Old Colony Trust Co., Boston, transfer agent. Calls on capital stock have been as follows: $5 on organization; $3, June, 1900; $6, June, 1901; $2, October, 1902: $2, June, 1903; $1, September, 1904; $1, January, 1905.

Official returns to the state of Michigan as of date Jan. 1, 1905,disclose the following figures:

Amount of cash paid in on capital stock	$1,850,000.00
Amount paid in by conveyance of property	250,000.00
Entire amount invested in real estate	250,000.00
Amount of personal estate	87,203.94
Amount of floating debt	50,127.25
Amount due company	49,479.72

Lands include the old Adventure and Hilton tracts, in one body to the eastward, and the Knowlton tract, lying a mile southwest, with total area of 1,696.22 acres on the mineral belt, also a millsite on Lake Superior. The mineral lands are located in Sections 35 and 36, Town 51 North, Range 38 West, and in Sections 1 and 2, Town 50 North, Range 39 West. The Toltecs and part of the Belt lie on the North, Aztec on the east, Teoltec and Mass on the south, and the Mass on the west of the main tract. The Knowlton tract has the Mass to the north and east, Flint Steel to the south and Michigan to the west, the Ridge mine of the Mass lying between the two Adventure tracts. The village of Greenland lies on the northwestern corner of the Adventure's principal tract, and the village of Maple Grove, controlled by the company, is near the mine.

The old Adventure mine was opened in 1850, along a line of ancient pits showing prehistoric mining. The largest annual production was 116 tons. 1,941 lbs. fine copper, in 1857. After closed by the owners, the old openings were worked for years by tributors, with good results, being notably rich in silver.

The Hilton, or Ohio mine, opened in 1863, on the Mass lode, never was worked vigorously. The Knowlton was opened in 1853. These three old mines made 974 tons, 1,173 lbs. fine copper, previous to their merging as

the Adventure Consolidated. Work was started Nov. 1, 1898, by the present company.

The Adventure has a series of 7 parallel copper-bearing beds in a cross-section of about 1,200′, and these, coupled with the existence of Adventure Bluff, a 300′ hill, have caused the opening of the mine by adits as well as by shafts. The "South Range," or "Evergreen Belt" of Ontanagon county, comprises a belt of bedded traps, amygdaloids and conglomerates, 7 of these amygdaloids carrying copper on the Adventure tract. These lodes, from north to south,are as follows:

(1.) Knowlton. This is the bed on which the shafts of the mine are opened, and apparently is the richest, ranging 4′ to 28′ in width, with an average of about 10′. It carries epidote, chlorite, prehnite, and the minerals commonly found associated with these in the Keweenawan series. A considerable part of the product is heavy copper.

(2.) Merchants. Underlies the Knowlton bed at a distance of 20′ to 65′, and averages about 10′ width. Is a stamp lode, but has produced masses up to 500 pounds weight, and is opened by crosscuts, with considerable drifting.

(3.) Mass. A continuation of the same lode found at the Ridge mine of the Mass Consolidated. Averages 10′ width and lies 100′ south of the Merchants. Carries no heavy copper and but little stamp-rock. In the Hilton, to the east, the Mass lode shows good rock, as it does also in the Knowlton mine, to the southwest.

(4.) North Butler. Lies nearly 100′ south of the Mass, and carries some copper, but has not been tested extensively.

(5.) Butler, or Champion. Is the most vigorous amygdaloid in the property, ranging 12′ to 50′ in width, with an average of about 20′, and lies nearly 200′ south of the North Butler. Ranges in value from very rich to absolutely worthless, carrying masses to a considerable extent, and always has been noted for its richness in silver, but in proportion to its great width gives but a small amount of stamp-rock, though fine stopes are opened occasionally. This bed apparently has a felsite base, and chemically and mineralogically differs from the parallel strata on either side. A large amount of opening work has been done on this lode, and the Butler, next to the Knowlton, has the most development and gives the best showing of any of the seven parallel beds of the mine.

(6.) Ogima. Lies about 100′ south of the Butler, and has been but little opened on the Adventure, but shows some good stamp-rock in places, though very bunchy.

(7.) Evergreen. Lies about 250′ south of the footwall of the Ogima, and averages about 10′ width. Has produced considerable copper at adjoining mines. The Evergreen has been tapped by a crosscut from the sixth level of No. 3 shaft, showing encouraging copper ground. The Evergreen is the best lode of the Mass mine, but has been given little attention at the Adventure.

The cupriferous lodes of the Evergreen belt are notoriously bunchy,

being rich in spots and worthless at other points. The strike of the parallel lodes of the Adventure is N. 73° E. on the main tract, where operations are now in progress, and the shafts are sunk at an angle of 45°. There are 4 tunnels, and 4 shafts, latter, except No. 1, in the Merchant lode, being sunk on the Knowlton bed, at 45°, and numbered from west to east.

No. 1 shaft has three compartments, 7x18′ inside of timbers, and is 1,180′ deep. Surface equipment includes a 38x59′ steel boiler-house with three 500-h. p. Burt boilers; a 59x59′ steel engine-house having an Allis-Chalmers double-cone duplex direct-acting hoist with 42x60″ cylinders, capable of raising a 12-ton load from a depth of 5,000′ on an incline of 45° at a speed of 2,000′ per minute, and a 38x65′ steel compressor-house, with a 60-drill Rand-Corliss air-compressor of high efficiency. No. 1 shafthouse and rockhouse are separate buildings, 200′ apart.

No. 2 is a 2-compartment shaft, 6x12′ inside of timbers, and was discontinued at depth of 190′ and hoist removed.

No. 3 is a 3-compartment shaft, 7x18′ inside of timbers, 865′ deep, with a 42x84′ combination steel shaft-rockhouse 116′ high. The 59x59′ engine-house is of wood, with a duplicate of the hoist at No. 1. This is the principal shaft of the mine, and the east drifts toward No. 4, are showing well in the lower levels.

No. 4 shaft, 2,200′ east of No. 3, was started Sept. 1, 1905, and was 187 deep at end of the year. This shaft also is on the Knowlton bed, and shows a lode of 8′ at the ledge, widening to about 16′ at the bottom, and gives an encouraging showing of copper. A temporary shaft-rockhouse has been built, and rail connections were supplied in the spring of 1906, and it is hoped that No. 4 may become an important producer.

No. 5 is merely a tentative site for a shaft, about 1,000′ east of No. 4, marked by a trench across the Knowlton lode, which shows rather encouraging rock at that point. The principal promise of the mine is on the Knowlton lode, in the eastern part of the mine. The parallel lodes have been prospected to a slight extent by crosscuts driven south from shafts 1 and 2. The mine was working 33 power drills at the close of 1905.

Water for boilers is taken from a stream dammed near No. 1 shaft. The mine has a complete electric light and power plant, and an electric haulage plant in the Butler tunnel. The principal mine buildings are sheathed with steel and painted, and the mine location is exceptionally attractive. Protection from fire is secured by water mains, fed from a reservoir on Adventure Bluff. The mine is served by a spur of the Copper Range Railroad.

The stampmill, at Edgemere, on Lake Superior, went into commission Sept. 22, 1902. The mill, built and equipped by the Allis-Chalmers Co., is 135x217′, of steel on stone foundations, with a 69x72′ boiler house and 32x72′ pump-house. Equipment includes 3 Allis-Chalmers heads, fitted with Parnall-Krause mortars having 11-16″ openings in discharge screens, with two horizontal revolving screens having 5-16″ openings for each head. The stamp pistons are automatically rotated, equalizing wear on the shoes. From the revolving screens of the heads the crushed rock goes to the separator jigs, 24

for each head, or 72 for the mill, thence to 36 finisher jigs. There are round slime-tables, 3 Overstrom and 3 Wilfley concentrators, and Huntington mills for the raggings. The rock-bins have a storage capacity of 4,500 tons. Coal is delivered from trestles to boiler-rooms by gravity, through chutes. The pump is a 16,000,000-gallon Riedler, drawing its supply from Lake Superior through a tunnel extending 1,200′ under the lake. Miscellaneous improvements at the millsite include an office, smithy, machine-shop, dwellings, etc. There is 8′ to 12′ of clear water off shore, permitting the landing of cargoes from scows, in good weather.

The fortunes of the Adventure were at a very low ebb when the management of the mine was taken by Mr. Brady, on April 1, 1904. In fact the management took a referendum vote of shareholders to decide whether a dollar assessment should be levied, or the sponge thrown up for good. High-water mark in production was reached June, 1903, with an output of 155 tons of mineral, after which producton declined steadily until it reached 63 tons in April, 1904. The decrease was due to lack of stoping ground. Under Mr. Brady's careful management production has been increased slowly, and reached 144 tons in January, 1906. At the same time reserve stopes have been increased and the general underground position greatly strengthened.

In the calendar year 1903, the Adventure made 2,182,608 lbs. fine copper, and expended $140,982.42 more than its earnings. In 1904 the production was 1,380,480 lbs. fine copper and outgo exceeded income by $92,032.08. In 1905 the output of fine copper was 1,606,208 lbs., and balance of expenditures over earnings was $88,651.00, this including $14,195.47 for construction account. On the face of matters, the showing is not very encouraging, but inspection of the work under way gives a more hopeful appearance to the case. The mine's monthly product is growing slowly, reserve stopes are being increased, and better ground is being opened in the eastern part of the mine. There is not, in Lake Superior, a more capable and upright mine manager than Mr. Brady. He was called into the case as a last attempt to save the patient's life, when an autopsy seemed the next step in the proceedings. He has done very well indeed, in the face of great difficulties, and if the Adventure can be made a paying mine, Mr. Brady will make it such. The shareholders should remember that Mr. Brady, beyond question, saved the life of the mine in 1904, and they should give him a chance to put the property on its feet—a process that will require time and money.

AETNA GOLD & COPPER MINING CO. **UTAH.**

Formerly operated at Bingham Canyon, Salt Lake Co., Utah.

AETNA MINE. **MICHIGAN.**

Sold, 1905, to Keweenaw Copper Co.

AETNA MINING CO. **COLORADO.**

Letter returned unclaimed from former mine office, Bonanza, Colo.

AETNA MINING CO. **WYOMING.**

Office: care of R. H. Fehland, president, Merrill, Wis. Mine office: Riverside, Carbon Co., Wyo. Julius Thielman, secretary; Roger Daniels, superintendent. Organized under laws of Wyoming, with capitalization $1,000,000

shares $1 par. Lands, 7 claims, area 140 acres, in the vicinity of Beaver Creek, circa 12 miles south of Encampment, showing 4 veins of 3′ to 6′ width, as fissures and as contact veins between granite and quartzite, carrying chalcopyrite, bornite and chalcocite, estimated to average 25% copper, and developed by a shaft of 200′ and tunnels of 125′ and 380′. Has a 40-h. p. steam plant.

AFORTUNADA COPPER MINES, LTD. **SPAIN.**

Title changed, 1903 to Rio Rimal Copper Co., Ltd.

AFRICAN & AUSTRALIAN CO., LTD. **AUSTRALIA.**

Offices: Broad Street House, London, E. C., Eng. J. B. Palmer, chairman; H. J. Dixon, secretary. Organized April 7, 1902, as a third reconstruction of the West Australian Mining Co. and Victoria Copper Co., with capitalization £120,000 shares 2s. par. Holds stock interests in the Copper Selection Syndicate, Ltd., and various other enterprises.

AFRICAN NOBLE DUKE GOLD & COPPER MINING CO. **ARIZONA.**

Office and mine: P. O. Box 1351, Bisbee, Cochise Co., Ariz. George W. Vandermark, president; Joseph Hughes, vice-president. Company does not pay its debts and apparently is moribund.

AFTERTHOUGHT MINING CO. **CALIFORNIA.**

Dead. Lands sold to Great Western Gold Co.

AFTON MINING & SMELTING CO. **MONTANA.**

Letter returned unclaimed from former office, Helena, Mont. Described in Vol. V.

AGASSIZ MINING CO. **ARIZONA.**

Office: 92 State St., Boston, Mass.. Letter returned unclaimed from former mine office, Ray, Pinal Co., Ariz. Organized 1900, with capitalization $1,250,000, shares $1 par. Lands 17 claims, also 40 acres of placer gold property, on the Gila river, near Ray. Idle and apparently moribund.

AGATE HARBOR MINE. **MICHIGAN.**

Office: care of Mrs. Anna Scott Block, owner, 100 Washington St., Chicago, Ills. Lands, in Keweenaw county, Michigan, have been slightly prospected, but property never was a producer.

GEWERKSCHAFT AGNESENHÜTTE. **GERMANY.**

Has sundry mines of iron and copper pyrites in Hessen-Nassau, Germany.

AGORDO MINE. **ITALY.**

A small copper mine in the province of Venetia, Italy.

MINA AGUA BLANCA. **MEXICO.**

Is controlled by the Dwight Furness Co. A partly developed property, about ten hours' ride (horseback), northwest of Autlán, Jalisco, Mexico. Property considered promising.

AGUASCALIENTES METAL CO. **MEXICO.**

Office and mine: Asientos, Aguascalientes, Mex. Employs 600 men. Dr. Chas. L. Bennett, president; Kuno Doerr, vice-president; Victor Hunton, secretary; Albert Doerr, general manager. Organized Dec. 31, 1900, under laws of Mexico, with capitalization $35,000, Mexican, shares $500 par. Is operated as a close corporation. On Dec. 31, 1905, had quick assets of $150,000, including $50,000 cash, Mexican, and was without accrued liabilities. Lands,

82 pertenencias, area circa 200 acres, in the Asientos and Tepezalá distri
showing 5 ore bodies, of which 4 are being developed, these having ave
widths of 5′ traceable, 1,000′, and carrying average values of 3% to 7% c
per, 10 oz. silver and 0.1 oz. gold per ton, in oxide, carbonate and sulphide o
The Merced-Orito mine, 8 kilometers west of Cobre station, on the Mexi
Union Railway, has shafts of 250′ and 300′ and the San Simon y Anexas h
tunnels of 100′ and of 125 meters length. Mine has about 2 miles of u
ground openings. Has a 110-h. p. De Laval steam turbine dynamo, h
and Cameron electric triplex pump, at the Merced-Orito. Has electric ho
of 20-h. p. and of 50-h. p., good respectively for 1,000′ and 3,000′ de
with a good power-house and other necessary mine buildings. The Mexi
Central railroad reaches the mines. Output averages 1,250 tons of
monthly and is sold to the Aguascalientes works of the American Smel
& Refining Co. Production, 1905, was about 1,250,000 lbs. fine copp
125,000 oz. silver and 1,800 oz. gold. Estimated output of fine copper
1906 is 1,750,000 lbs. Management is good, and the property is conside
to be of much more than average promise.

MINA AGUILA. MEXI

In the Sierra Ponces, Chihuahua, Mexico. White & Duran, operators,
last accounts. Has argentiferous copper ore.

AHMEEK MINING CO. MICHIG

Office: 199 Washington St., Boston, Mass. Operating office: Hough
Mich. Mine office: Kearsarge, Keweenaw Co., Mich. Albert S. Bigel
president; Norman W. Haire, vice-president and general manager; W. J. L
secretary and treasurer; Wm. J. Uren, general superintendent; Russell S
surface superintendent; Thomas Rapson, chief mining captain; Chas. D. He
engineer; John T. Reeder, chief clerk and purchasing agent; Wm. Veale, cl
H. B. Clausen, superintendent motive power. Organized 1880, under l
of Michigan, with capitalization $1,250,000, shares $25 par; $17 paid
Last call on capital stock was $5, February 5, 1905.

Official returns to the state of Michigan as of date, Jan. 1, 1905, c
close the following figures:

Amount of cash paid in on capital stock	$350,000
Amount paid in by conveyance of property	500,000
Entire amount invested in real estate	499,000
Amount of personal estate	186,640
Amount of floating debt	19,588

Lands 920 acres, lying west and south of the Mohawk. Was se
in 1880, by the Seneca Mining Co., to work the Kearsarge, or Hough
conglomerate, and under the management of Capt. John Daniell sunk 2 sh
in this bed, which averages about 70′ width, with 3 paystreaks, of 2′ to
width each, aggregating 7′ width, each carrying copper in good quantit
but not payable, owing to great width of partially or wholly barren ro
Resumed work December 2, 1902, and exchanged 11.188 acres with the A
louez, in July, 1903, for an equal area, this giving each property a better a
rangement of lands for development. The Kearsarge lode was located b

diamond drill in the spring of 1903, and immediately opened by a 137′ crosscut sent from the bottom of an old 100′ vertical shaft. The bed was found both wide and strong, carrying a high grade of stamp-rock and heavy copper, fully equal in appearance to almost any other opening on the great Kearsarge lode. The crosscut also showed finely disseminated copper in the footwall for 20′ before reaching the lode. Drifting was begun when the lode was reached, and an incline shaft, known as No. 1, was holed through to the surface by an upraise from below.

The mine is opened by two shafts, 1,445′ apart. Owing to the peculiar configuration of the Ahmeek tract, there is no room for additional shafts. No. 1 was 740′ and No. 2 was 853′ deep at the close of 1905. Ten power drills are in use, of which 6 are drifting, 1 sinking, and 3 stoping. More could be used were there sufficient compressor capacity. The shafts are connected, as yet, on the first level only, but further connections will be secured during 1907. Drift-stopes are carried, permitting a considerable production, and the stopes opened are of good grade throughout. No. 1 shaft, which will be cut off by the side-lines of the Allouez, at a depth of slightly less than 3,000′, apparently is the richer of the two. In sinking these shafts, concrete was substituted for wooden sleepers. Concrete ties were moulded in place upon the natural anchorage of rough rock, cores being left for rods to bolt the rails to the stringers. The concrete stringers are cheaper than those of wood, and presumably of longer life, though harder upon the rails and rolling-stock. Each shaft has two skips in operation. Each shaft is to have a shafthouse, with trolley to the centrally located rockhouse, adjoining the power plant. The rockhouse, of brick, is to have a cylindrical steel rock-bin, 32′ in diameter and 45′ high, with concrete foundation, and a tunnel with railroad track beneath, so that cars can be filled directly from the bin, by gravity alone.

The power plant, midway between the shafts, has a boiler-house of structural steel and a power-house of brick. The power-house is to have 2 double conical drum hoists, of one mile capacity each, and a high-duty air-compressor, latter under erection early in 1906. The power-house really is in three sections, with the boiler-house between, flanked on either hand by engine-houses Nos. 1 and 2, for the respective shafts. The boiler-house has five boilers, with room for eight.

A complete geological cross-section of the Ahmeek tract was secured in 1904, by diamond drill borings. Production was begun April 21, 1904, at the Tamarack mill. One head at the Isle Royale mill was leased late in 1904. Rock is furnished from drift-stopes, carried 10′ to 18′ high, and the full width of the lode. In this way a considerable production is secured, going a long way toward paying for development. Production, 1905, was 1,552,957 lbs. fine copper. The Ahmeek is well managed, and is certain to make one of the best amygdaloid mines of the Lake Superior district.

COMPAGNIE DES MINES D'AÏN-BARBAR. ALGERIA.

Offices: 39, Rue Dulong, Paris, France. Mine, in the department of

Constantine, Algeria, shows several veins of chalcopyrite, assaying 8% to 15% copper, associated with sphalerite and galena. Idle since 1899.

AJAX GROUP. **BRITISH COLUMBIA.**

On Valdes Island, Nanaimo district, B. C. A prospect, from which 30 tons of ore yielded 25% copper and $6 gold and silver per ton. Idle for several years.

AJAX MINE. **MONTANA.**

Mine office: Fox, Beaverhead Co., Mont. Noyes & Morse, owners; W. B. Stanchfield, superintendent, at last accounts. Ores carry gold, silver, lead and copper. Has steam power and a 5-stamp mill.

AJAX MINING CO **UTAH.**

Office: Salt Lake City, Utah. Thos. Weir, president and general manager; John M. Burt, secretary. Property is operated by lessees, under contract with management of the property. For the year ending Oct. 1, 1905, production was 5,077 tons of ore of all grades, carrying average values of 3.75% copper, 8.85 oz. silver and $7 gold per ton. The first-class ore, 243 tons, carried upwards of 15% copper. Main shaft is 1,000′ in depth, and the mine has considerable underground development. The company seems well handled and mine is regarded as promising.

AJO COPPER MOUNTAIN MINES CO. **ARIZONA.**

Office 237 Crossley Bldg., San Francisco, Cal. Mine office: Gila Bend, Maricopa Co., Ariz. Chas. Henderson, president; O. F. Melden, secretary; Anthony Bray, superintendent. Capitalization $1,000,000, shares $5 par. Holds the Ajo mines, including the Shotwell mine in the Ajo Basin, 120 miles south of Tucson and 170 miles southeast of Yuma, under bond and lease from Thos. Doak & Son, owners. Property includes antiguas, first opened 1763, and worked by Spaniards and Mexicans, which have produced considerable rich copper ore, including native copper, shipped to Swansea and San Francisco for reduction. The Shotwell mine has a 10-stamp mill and 2 Woodbury concentrators. Property is rich, but handicapped by lack of adequate transportation facilities.

AK-SAR-BEN COPPER CO. **WYOMING.**

Mine office: Encampment, Carbon Co., Wyo. A. H. Crow, superintendent. Property has a strong gossan capping of hematite and limonite, and an 80′ shaft, with small steam plant, and is worked intermittently, as the company can raise funds.

ALABASTER CAVE GROUP. **CALIFORNIA.**

Office: care of Holmes Lime Co., owners, 22 Sacramento St., San Francisco, Cal. Lands, 180 acres, 7 miles east of Newcastle, Placer County, California. Vein is traceable 6 miles, with strong gossan outcrop. Ore is said to average 4% copper, from paystreak of 3′ to 8′ in a contact vein 12′ to 20′ wide between limestone and slate. Idle.

ALACRAN MINE. **MEXICO.**

Owned by Moctezuma-Arizpe Development Co., S. A.

ALADDIN MINING CO. **MONTANA.**

Mine office: Clinton, Missoula Co. Mont. Idle for some years.

ALAMEDA MINING CO. **WYOMING.**

Office: care of P. J. Winters, manager, Encampment, Wyo. Mine office: Saratoga, Carbon Co., Wyo. Lands, three claims, near the Charter Oak property, opened by shallow shafts, deepest 30′, and a 100′ tunnel, said to show encouraging ore.

ALAMO COPPER CO. **ARIZONA.**

Said to have copper claims near Ajo, Arizona, but not found.

ALAMOS MINING CO. **MEXICO.**

Office: care L. C. Hanks, secretary and treasurer, Douglas, Ariz. Harry F. Smith, president. Organized February, 1906. Lands, sundry claims below Guaymas, in the Alamos district of Sonora, Mexico, slightly developed, said to show argentiferous copper ores. Company is said to plan erecting a smelter.

ALASKA AMALGAMATED COPPER CO. **WASH.**

Office: care of E. V. Dillman, Seattle, Wash. W. A. Mears, president. Organized 1906, with capitalization $1,250,000. Lands, sundry claims on the Nazina river, an affluent of the Copper river, said to show ores ranging from 10% to 65% in copper tenor. Company expects to secure railroad connection in 1907, by a line building from Valdez to the Bonanza mines, which will permit the operation of central Alaskan copper mines, now handicapped by entire lack of modern transportation facilities.

ALASKA CALUMET COPPER CO. **ALASKA.**

Office: 645 New York Blk., Seattle Wash. Mine office: Valdez, Alaska. Employs 4 men. H. M. Herrin, president; F. Freeman Evans, secretary; Walter Bowen, treasurer. Organized Jan. 13, 1906, under laws of Washington, with capitalization $2,000,000, shares $1 par. Lands, two groups of claims, area not given, adjoining the property of the Hubbard-Elliott, showing bornite assaying up to 56% copper and $169 gold and silver per ton. Property will be served, eventually, by the Copper River & Northwestern and Cordova Bay railroads, both under construction, early in 1906.

ALASKA COPPER CO. **ALASKA.**

Office: 316 Globe Bldg., Seattle, Wash. Mine office: Coppermount, Prince of Wales Island, Alaska. Henry W. Mellen, president and general manager; Frank T. Hunter, vice-president; Arthur S. Lovett, secretary; D. H. Roe, treasurer; Frank W. Hale, general manager; preceding officers, R. W. A. Simmons, C. E. Lovett, Henry Wellington Wack, Stewart H. Moore and H. T. Granger, directors; R. W. Gilson, superintendent; J. Cuthbert Welch, smelter superintendent; D. D. Stewart, mine superintendent. Organized Feb. 28, 1903, under laws of Washington, with capitalization $5,000,000, shares $25 par.

Lands, 18 patented claims, area 360 acres, also 18 patented millsites, area 80 acres, giving 1¼ miles frontage on Copper Harbor, a land-locked haven with deep water. Lands are on Copper Mountain, rising to a height of 3,600′ directly from the harbor. Property is estimated to carry 20,000,000′ of marketable timber, and actuates all machinery by waterpower, partially developed by a 22′ steel pipe-line of 1,000′ from Reynolds Creek to the power

plant, where there are 2 water-wheels of 300-h. p., total available power being estimated at 2,800 h. p.

Three veins are being developed, ofwhich the Brooklyn, 10′ to 30′ wide, shows chalcopyrite assaying 3% to 34% copper. The New York vein is a contact between porphyry and limestone, 10′ to 60′ wide, and 500 tons of selected ore therefrom gave smelter returns of 16.9% to 29.06% copper. The principal vein is the Indiana, in limestone near a porphyry intrusion, with extreme width of 280′, giving average assays of 5% copper and $6 gold per ton. Mine has shafts of 40′, 60′, 90′, 110′, 230′, and 230′. Principal development is by tunnels, permitting cheap extraction. Has 8 tunnels, of 70′ to 2,900′ length, with a total of 4,440′ of underground openings, estimated to give 195,000 tons of ore blocked out for stoping. Ores are oxides and carbonates, with occasional native copper near surface, and sulphides at depth. Equipment includes a 500-h. p. water-power plant, with ten times as much available for future development. There is a sawmill on the property, of 15,000′ daily capacity. Buildings include a 30′x60′ frame machine-shop, 20′x70′ frame carpenter-shop, 24x36′ smithy, and various bunk-houses and other mine structures, with a total of 16 buildings, all of frame construction and substantially built.

A 1,400′ ground-tram takes ore from the main mine opening, along the ridge of Copper Mountain, to the head of an aerial tram, whence it is carried to the smelter. The smelter has a 350-ton Allis-Chalmers blast-furnace, making matte carrying 50% copper, 7 oz. to 8 oz. silver and 1.6 oz. gold per ton, which is sent to Tacoma for refining. Some custom smelting is done for small adjoining mines. There were serious delays in blowing in the smelter, and trouble with leaks in the water-jacket and unsatisfactory settlers, after blown in but production seems progressing more satisfactorily in 1906. The smelter is designed as the first half of a 700-ton unit.

The company owns a gasoline launch and has chartered a tug and barge. A general merchandise store is maintained. Ore smelted is said to be running better than 7%.

ALASKA COPPER & COAL CO. **ALASKA.**

Office: 146-45 Broadway, New York. Name changed from Alaska Copper Co. to present title to avoid confusion with Judge Mellen's company, of the same name, at Coppermount. Henry O. Havemeyer, Jr., president; Ernest Truslow, secretary and treasurer. Organized under laws of West Virginia, with capitalization $3,500,000, shares $10 par. Property is known officially as the Kennicott group, but is more commonly known as the Bonanza group, located 180 miles by rail northeast of Valdez, Alaska. This property was claimed by the Copper River Mining Co., and also by the Chittna Exploration Co., but patents to the 3,000 acres comprising the tract have been issued by the United States government to the Alaska Copper & Coal Co., whose title is perfect. At last accounts from Alaska, exploratory work was in progress and the property was guarded by armed men, acting under instructions to prevent all trespassing. Property is one of exceptional promise and bids fair to make a very large and rich mine. Management of the company is ex-

cellent. The Guggenheim interests apparently have become interested recently in the property.

ALASKA GOLD & COPPER CO. **ALASKA.**

Title changed to Central Alaska Gold & Copper Co.

ALASKA IMPERIAL MINING CO. **ALASKA.**

Offices: Helsingborg, Sweden, and Seattle, Wash. Mine offices: Coppermount, Prince of Wales Island, Alaska, and Ketchikan, Alaska. O. Gerle, president; Frank Kennedy, secretary. Capitalization $2,000,000, shares $100 par. Lands, sundry claims on Prince of Wales Island, carrying a contact vein between granite and limestone showing ores, associated with epidote and hemitite, and carrying good gold values, similar to those of the Alaska Copper Co., which adjoins. Development is largely by surface trenching, with some tunneling and crosscutting. Also has lands on Dall Island, Long Island, Brafield Canal and Red Bluff Bay, in the Ketchikan district.

ALASKA IMPROVEMENT CO. **ALASKA.**

Mine office: Ketchikan, Alaska. Is said to have leased the property of the Grindall Mining and Smelting Co., on the Kasaan peninsula.

ALASKA INDUSTRIAL CO. **ALASKA**

Office: 11 Broadway, New York. Mine office, Sulzer, Prince of Wales Island, Alaska. Employs 25 men. Hon. John P. Jones, president; Robert A. Lawrie, vice-president; Louis A. Sarecky, secretary; Alex M. Lowry, treasurer; Chas. A. Sulzer, general manager. Organized 1899, under laws of New Jersey, with capitalization $1,000,000, shares $1 par. Company has no liabilities. Annual meeting, second Monday in November.

Lands, 60 patented claims, area 1,200 acres, also a 60-acre millsite and an 80-acre townsite. Has 7 wide contact veins, between granite and limestone, said to give average assays of 6% copper, 3 oz. silver and $3 gold per ton. Ores are mainly chalcopyrite, with some bornite, malachite and azurite and a little tetrahedrite. Development is by 4 shallow shafts, deepest 60′, and by tunnels, of 30′ to 225′ length, giving 1,570′ of mine openings, also 43 open-cuts, estimated to show 200,000 tons of ore, with 100,000 tons blocked out for stoping.

A water-power of about 5,000 h. p. is available on the property. Electric light is furnished by a 6-kw. generator, actuated by a 36″ Pelton wheel. Improvements include 15 bunk-houses and cabins, a 35x70′ general store, power house, offices, etc. Company has a 47′ gasoline launch for purposes of general utility, and has tide-water transportation at the mine. Material for a 2-mile aerial tram was partly delivered, early in 1906. A 200′ wharf with 3,000-ton ore-bins is being built for ore shipments during 1906. Property is considered promising and management good.

ALASKA MINING CO. **UTAH.**

Mine office: Silver City, Juab Co., Utah. Presumably idle.

ALASKA SMELTING & REFINING CO. **ALASKA.**

Office: care of Samuel I. Silverman, general manager, Spokane, Wash. Mine office: Coppermount, Prince of Wales Island, Alaska. Is an auxiliary corporation of the Brown-Alaska company. Paul Johnson, smelter superin-

tendent. Has a small but complete smelting plant, erected 1903–1904, a plans doing a general custom smelting business.

ALAWERDI MINE. RU

Described under title Alverdski group

ALBERNI GOLD & COPPER CO., LTD. BRITISH COLUM

Letter returned unclaimed from former mine office, Alberni, Vanco Island, B. C. Property was the Thistle group, on Douglas Mountain, sho chalcopyrite assaying up to 1 oz. gold per ton.

ALBION COPPER MINING CO. MONTA

Mine office: Sunday, Granite Co., Mont. Christian Reichert presid James M. Hinkle, secretary. Lands, opened by tunnels, show 3 veins, ca ing concentrating ore with values in copper, lead, silver and gold.

ALBION MINING CO. UTA

Office: care of Hatfield & Sons, Salt Lake City, Utah. Wm. Hatfi general manager. Property is the Albion group, in Little Cottonwood Ca Salt Lake county, which is said to have yielded about one million dol worth of ore under former ownership. A tunnel of 2,800′, being driven drain old workings and open new ground, shows a fissure vein giving 1 copper ore, with silver values. Has water power.

ALDA COPPER MINES, LTD. SPA

Offices: Dashwood House, London, E. C., Eng. Mine office: Cabra Asturias, Spain. W. T. Rushton, secretary. Organized June 8, 1900, a reconstruction of Alda Mining and Smelting Co., Ltd., with capitalizat £130,000, shares £1 par. Debentures, £10,000 authorized, £8,050 issu at 7%.

ALDA MINING & SMELTING CO., LTD. SPA

Reorganized, 1900, as Alda Copper Mines, Ltd.

SOCIETE MINIERE D'ALDEIRE. SPA

Mine office: Aldeire, Gaudix, Granada, Spain. Presumably idle.

COMPANHIA MINEIRA ALEMTEJANA. PORTUG

Office: 4, Praca dos Remolares, Lisbon, Portugal. Mine office: B Alemetjo, Portugal. Waldemar d'Orey, superintendent. Property is a gro of old mines in the San Domingos district, showing two ore bodies occurri in schists, the selected products giving about 25% copper, from carbon and sulphide ores. Mines were discovered and worked by the Romans.

ALESSANDRO COPPER MINING CO. NEW MEXICO

Office: 35 Union St., New Haven, Conn. Mine office: Silver City, Gra Co., N. M. Joseph C. Kelly, president; Edw. Parkhurst, secretary; Pet McQuaid, manager. Organized April, 1900, under laws of West Virgin with capitalization $500,000 shares $1 par. Debentures, $100,000 authorize at 6%; issued, $5,000. Lands, 50 claims, area 1,000 cares, also a 5-acre mi site, in the White Signal, Burro and Anderson districts. Is developing 9 o bodies, occurring as lenses or impregnations in the neighborhood of po phyry, these being claimed to give average assay values of 8% copp and 5 oz. to 40 oz. silver per ton, principally from carbonate an

sulphide ores. Has 9 shafts, from 40′ to 225′ in depth, also 9 tunnels, from 15′ to 400′ in length, with total underground openings of 1,300′. Has steam power, necessary mine buildings, 5-ton concentrator and leaching plant.

ALGOL MINE. **CALIFORNIA.**

Mine office: Spenceville, Nevada Co., Cal. Opened circa 1865 and reopened 1899. Has a 50′ vein, with 2″ to 10″ paystreak, opened by two shafts, each 120′. Ores are cuprite, malachite and azurite, also native copper and a little gold, giving average smelter returns of 20% copper. Has steam power. Presumably idle.

ALGOMA & CALUMET DEVELOPMENT CO. **ONTARIO.**

Dead. Lands transferred, June, 1903, to Hermina Mining Co., Ltd.

ALGOMA COMMERCIAL CO., LTD. **ONTARIO.**

Office: Sault Ste Marie, Ont. C. M. Boss, superintendent. Property includes the Elsie, Wilmot and other mines, 4 miles from Sudbury, Algoma, Ontario. Is closely allied with the Lake Superior Power Co.

ALGOMA COPPER & SMELTING CO. **ONTARIO.**

Office: care of Eugene Warner, vice-president, Prudential Bldg., Buffalo, N. Y. Mine office: Bruce Mine, Algoma, Ont. Mark B. Schwabe, president; Ben. Newman, secretary; Bernard J. Hillman, treasurer. Organized, circa 1905, under laws of Arizona, with capitalization $3,000,000, shares $10 par. Lands, 1,550 acres, circa 9 miles from Bruce Mine, opened by a 425′ shaft and a 175′ tunnel. Has a 300-ton concentrator. No recent developments, and company apparently inactive.

ALGONQUIN COPPER CO. **WYOMING.**

Office: 177 Broadway, New York. Henry H. Adams, secretary. Organized under laws of Wyoming, with capitalization $1,000,000.

MINA EL ALICANTE. **MEXICO.**

Mine office: Mazipil, Zacatecas, Mex. M. Dolores Aguirre y Ca., owners; Vicente Banavides, superintendent. Ores carry gold, silver, lead and copper. Employed about fifty men, at last accounts.

ALICANTE GROUP. **COLORADO.**

Letter returned unclaimed from former mine office, Wortman, Lake Co., Colo. Property has ores carrying gold, silver, lead, copper and zinc, with steam power and a 35-ton concentrator.

ALICE GOLD MINING CO. **WASHINGTON.**

Office: 204 Empire State Bldg., Spokane, Wash. Mine office: Blue Creek, Stevens Co., Wash. J. F. Nylander, president; W. M. Higley, secretary and treasurer; Benjamin F. Parker, general manager. Organized 1896, under laws of Washington, with capitalization $150,000, shares 10 cents par. Lands, 11 claims, area 225 acres, in the Chewelah district, showing 4 fissure veins and lenses, latter of fair width and carrying sulphide ores giving good assay values in gold and copper, opened by two 200′ shafts and 2 short tunnels. Presumably idle.

ALICE GOLD & SILVER MINING CO. **MONTANA.**

Property is controlled by Butte Coalition Mining Co.

MINA DE ALJUSTREL. **PORTUGAL**

Mine office: Aljustrel, Portugal. Said to be owned by a Belgian company. Ore is chalcopyrite, associated with iron pyrites, carrying 1% to 7% copper. Mine is a small but steady producer.

ALLEGHENY MINING CO. **NEW JERSEY.**

Organized 1901, to work old copper mines in Pahaquarry township, near Delaware Water Gap, Warren County, New Jersey. Moribund.

ALLEN MINE. **OREGON.**

Office: care of Chas. d'Autremont, Jr., Duluth, Minn. Mine is located on the Rogue river, Oregon, and ores carry good values in gold and silver.

ALLENDE HERMANOS y CA. **SPAIN.**

Mine office: Elizondo, Navarra, Spain. Don Pedro Allende, superintendent.

ALLIANCE COPPER-GOLD CO. **BRITISH COLUMBIA.**

Mine office: Greenwood, Yale District, B. C. H. H. Shallenberger, superintendent. Shareholders supposed to be mainly residents of Minneapolis. Lands, sundry claims, including the Moreen, in the Deadwood camp, carrying low grade auriferous copper ores, developed by open-cuts.

ALLIANCE COPPER MINING CO. **WASHINGTON.**

Absorbed, 1902, by Iconoclast Consolidated Mines Co.

ALLIGATOR & TIGER LEASING CO. **COLORADO.**

Mine office: Red Cliff, Eagle Co., Colo. A. S. Little, manager. Lands, 2 claims, showing massive bornite and chalcopyrite, in fissure veins, traversing granite, ores assaying up to 15% copper, 5 % lead, 50 oz. silver and $10 gold per ton.

ALLOUEZ MINING CO. **MICHIGAN.**

Office: 60 State St., Boston, Mass. Mine office: Allouez, Keweenaw Co., Mich. H. F. Fay, president; Geo. G. Endicott, secretary and treasurer; Jas. Chynoweth, superintendent; preceding officers, Godfrey Morse, John C. Watson, Stephen R. Dow, Walter L. Frost, H. A. Tucker, and W. B. Mosman, directors. Organized 1859, reincorporated 1889, under laws of Michigan, with capitalization $2,500,000, shares $25 par; $22.25 paid in. Last assessment $3 per share, levied 1904. Annual meeting, second Tuesday in March.

Official returns to the state of Michigan, as of date Jan. 1, 1905, disclose the following figures:

Amount of cash paid in on capital stock	$2,214,672.50
Entire amount invested in real estate	130,103.39
Amount of personal estate	253,201.03
Amount of floating debt	8,464.50
Amount due company	1,218.75

Lands, circa 3,400 acres, including the tract of 640 acres on which the the old and new Allouez mines are opened. The boundary line between the Allouez and Ahmeek was improved, 1903, by the exchange of 11,188 acres.

The old mine, opened 1859, is on the Allouez conglomerate, a bed under-

lying the greenstone that is such a noticeable rock stratum in Keweenaw county. The conglomerate is 30′ wide in many places, with strike of N. 39° E., and dip of 38°. Lode averages returns of 0.7% to 1% copper, and is very refractory under the stamps. There are 3 shafts, deepest about 3,700′. Mining was begun actively in 1869, and stopped in 1877, with an exhausted treasury. The mine was then leased to Watson & Walls, who made money from it, after paying a royalty of one-eighth on gross production. In 1880 the company resumed control, to quit once more, financially exhausted, in 1885. Watson & Walls took the mine again, and once more did well; the company resumed work on its own account for the third time, and again lost money, stopping all work in 1892. The old mine has been idle for some years, except for exploratory and development work in 1898-1900, when a shaft was sunk 1,200′ on the Osceola lode, and nearly 4,000′ of openings secured thereon, with different results. The shafthouse at the Osceola shaft has been demolished. The stampmill, on Hills Creek, has three old-fashioned heads and cannot be used for the new mine. The old Allouez made 13,025 tons, 1,528 lbs. fine copper, 1869-1892.

A new mine is being opened on the Kearsarge amygdaloid bed, which does not outcrop on the Allouez tract, hence was opened, through necessity, on the underlay. This bed extends under the entire 640-acre tract. No. 1 shaft was started May 15, 1903, on the extreme southeastern corner of the tract, and Dec. 31, 1905, was 1,775′ deep, cutting the lode at 1,480′. The first level is at 1,264′ depth, reaching the lode by a crosscut sent east. This shaft leaves surface at 75°, but at little depth takes an angle of 80°, continuing until a depth of about 1,435′, when a curve of 60′ brings the shaft to an angle of 38° 30′, to correspond with the lode at the third level. No. 1 shaft has 3 compartments. Owing to the exceeding steepness of the shaft, only 10° less than vertical, backrails of 6x10″ timber are set so close to the wheels of the skips that their flanges cannot leave the steel rails, the wooden timbers serving as guides. At the change of angle from 80° to about 38° 30′ on reaching the lode, a single idler with a very wide flange cares for the cables passing at either end. In order to save pumping charges on surface-water entering the mine, a gutter has been cut entirely around the shaft, leading to an opening 36′ long, half winze and half drift, used as a sump from which the water is forked. The shaft has a 42x62′ steel shaft-rockhouse, with two 18x24″ crushers.

No. 2 shaft is located 2,000′ northeast of No. 1. Preliminary work was started late in 1904, but the country being very wet, it was necessary to sink drain shafts. The rock ledge was cut at 68′ and a permanent No. 2 shaft started late in 1905 and work resumed thereon in the spring of 1906. No. 2 shaft is very solidly planned and started. The collar is of concrete, Washington fir and 16x24″ steel "I" beams, with 14x14″ square timber wall-plates and 4″ plank sheathing. The interior, from collar to the ledge of solid rock, will be lined with a 22″ thickness of concrete, and the dividers will have their ends bedded in concrete. This should give an absolutely impregnable shaft, through the treacherous sand overburden. No. 1 shaft also is very solidly framed and timbered, an average of about 60′ of timber and lagging being used for each

foot of depth. Each shaft can be sunk about 9,500′ before reaching the western boundary of the property.

The new mine has been found rich from the first opening, the lode averaging 16′ to 18′ width, and of the rock broken only 5% to 8% is being discarded. The openings on the various levels are carried as drift-stopes from wall to wall, and to an average height of about 12′, the rock so broken furnishing the mine's production. Eighteen power-drills are in use, and, as depth is gained, openings are increasing rapidly in number and length.

The temporary hoist, good for a half mile depth, with which No. 1 shaft was sunk, has been removed to No. 2, and in June, 1905, a new hoist went into commisssion at No. 1. This is a Nordberg, with 32x72″ duplex cylinders and 18′ double conical drum. Foundations for necessary buildings were built at No. 1 shaft before permanent structures were begun.

The engine house is of mine-rock, with redstone trimmings. The stone boiler-house has five 125-h. p. boilers and a 120′ self-supported steel smokestack. There are 12-drill and 18-drill air-compressors, and eventually a large compressor house will be built at No. 2 shaft. Miscellaneous buildings, completed 1905, include redstone machine and blacksmith shops and a large warehouse. All improvements are of the most substantial nature and a credit to the mine and its management. The mine is reached by a spur of the Mineral Range railroad.

Production was begun Aug. 1, 1905, at the Centennial mill, where one stamp has been leased for 3 years, at a charge of 40 cents per ton. Production for 1905 was 1,167,957 lbs. fine copper, secured from 41,120 tons of rock stamped, giving an average return of 28.4 lbs. copper per ton—placing the Allouez second only to the Wolverine in richness among the amygdaloid mines of the Lake Superior district. That this average is a fair one, the circumstances render assured, as the production came from drift-stopes, just as the mine was opened, and the broken rock discarded amounted to but 6.85%. There was no opportunity for "sweetening" the returns, even had such a thing been desired. Rock production, at the beginning of 1906, was about 10,000 tons monthly, foreshadowing an output of about 3,500,000 lbs. fine copper in 1906. The Allouez management succeeded, during the last 5 months of 1905, in making a unique record by earning a mining profit of $54,660, and a net profit, over construction account and all other expenses of whatsoever nature, of $19,143. The future of the Allouez is assured, and the mine, which is a credit to its management, will make another and very possibly a greater Wolverine.

ALMA COPPER MINING CO. **MEXICO.**

Offices: Des Moines, Ia. Mine office: Carbo, Ures, Sonora, Mex. Abner Graves, general manager; Nelson D. Graves, superintendent. Lands, 747 acres, in the Ures district, showing auriferous, argentiferous and somewhat bismuthiferous copper ores, in the forms of cuprite, melaconite, malachite, azurite and chrysocolla, assaying up to 37% copper and $13 gold per ton. Has gasoline power.

ALMA GOLD MINING CO. **COLORADO.**

Office: Idaho Springs, Clear Creek Co., Colo. J. J. May, superintendent. Ores carry gold, silver and copper. Has steam power.

ALMA MINE. **BRITISH COLUMBIA.**

Letter returned unclaimed from former mine office, Lardo, B. C.

ALMA MINING & MILLING CO. **MEXICO.**

Office: care of P. B. McCabe, Los Angeles, Cal. Letter returned from former mine office, Canitas, Zacatecas, Mex. C. A. Heberlein, general manager. Organized 1903. Lands include the San Antonio, San Luis, Torrington and Rosario mines, showing ores carrying 15 oz. to 150 oz. silver per ton, with appreciable copper values.

ALMADO & TIRITO CONSOLIDATED MINING CO. **MEXICO.**

Succeeded by Negociacion Minera de Clemente Ybarra.

SOCIEDAD MINERA DE ALMANZORA. **SPAIN.**

Office: care of Don Camilo Bilarge, agent, Javier Sanz, 4, Almeria, Spain. Property includes sundry copper mines in Almeria. Idle at last accounts.

ALMEDA MINING CO. **OREGON.**

Office: 414 Abington Bldg., Portland, Ore. Mine office: Galice, Josephine Co., Ore. Employs 12 men. O. M. Crouch, president; R. C. Kinney, secretary and treasurer; John F. Wickham, general manager. Organized Sept. 17, 1900, under laws of Oregon, with capitalization $1,000,000, shares $1 par. Lands, 7 claims, area 140 acres, also a 5-acre millsite and 30 acres miscellaneous lands, in the Galice district, showing a contact vein between porphyry and slate, said to be 107′ wide and traceable 2,300′, giving average assays of 3% copper and $4.50 gold per ton, with traces of silver and lead, from chalcopyrite, developed by 8 tunnels, 2 longest 225′ and 420′. Was originally worked to slight depth for free gold, circa 1860-1870. Mine shows a large deposit of base ore, with fair gold values and small silver values, and with large development and equipment should make a paying property.

ALMERIA QUICKSILVER & COPPER CO., LTD. **SPAIN.**

In voluntary liquidation, early in 1906.

ALMOLOYA MINING CO. **MEXICO.**

Office: 305 Trust Bldg., Los Angeles, Cal. Mine office: Baca, Ramal de Parral, Chih., Mex. Employs 180 men. Nils O. Bagge, president; I. B. Newton, secretary; W. C. Paterson, treasurer; D. W. Shanks, general manager; D. C. Joslyn, mine superintendent; Los Angeles Trust Co. and New York Trust Co., registrars. Organized 1903, under laws of Arizona with capitalization $2,000,000, shares $1 par, in $800,000 preferred stock, at 10%, non-cumulative, and $1,200,000 common stock; issued, $1,400,000. Lands, 270 pertenencias, area 730 acres, also a 100-acre millsite, with total landed holdings of circa 1,000 acres, in the Allende district, about 4 miles from the railroad station at Baca. The Sierra de Almoloya is an isolated mountain range, about nine miles long, formation being limestone of Cretaceous age, with two eruptive intrusions. Property adjoins the well-known Cigarrero mine, which shows four ore bodies of good width. Development is

by shafts of 68′, 140′, 270′, 350′, and 540′, and by tunnels of 180′, 360′, 1,320′ and 1,600′, with a total of about 6,400′ of openings. In March, 1906, a 72′ body of low-grade ore was encountered, this being a decomposed deposit, carrying bunches of copper and lead, with gangue of iron and manganese ores, and presumably is the top of a large deposit of ore of good grade. Property has gasoline, electric, and pneumatic power, with a 60-h. p. producer gas plant for drills. Development to date has been conducted along sound lines, and property bids fair to develop a good mine,though this opinion is based more upon the probabilities of the situation than upon actual ore bodies opened to date.

ALPS MINING CO. **COLORADO.**

Mine office: Central City, Gilpin Co., Colo. Ores carry gold, silver and copper. Has steam power. Presumably idle.

ALSACIA DEVELOPMENT CO. **MEXICO.**

Reorganized, 1905, as Alsacia Mining Co.

ALSACIA MINING CO. **MEXICO.**

Office: care of Chas. F. Wrenn, secretary and general manager, Bisbee, Ariz. R. L. Whaley, president; John Hermann, engineer. Lands are 23 miles east of La Cananea, in the Ajo Mountains, Arizpe district, Sonora, Mexico, opened by a 400′ shaft. Drifts on the 350′ level show argentiferous copper ores giving average assay values of about $25 per ton. Vein is said to be widening. Machinery includes a hoist good for 1,000′. A wrangle among the shareholders has been settled, and the management plans continuing developments steadily.

ALTALTA MINING CO. **ARIZONA.**

Office: 145 La Salle St., Chicago, Ills. Mine office: Chloride, Mohave Co., Arizona. J. F. McBride, president; A. H. Dryden, superintendent. Ores carry gold, silver, lead and copper, precious metals predominating in value. Opened by shaft and has gasoline power. Employs 10 to 12 men, and management contemplates installation of a concentrating plant.

ALTA-IDAHO GOLD & COPPER MINING CO. **IDAHO.**

Office: care of John M. Nuss, secretary, Nescopek, Pa. Mine office: Pardee, Idaho Co., Idaho. Employs 12 men. J. B. Nuss, president; Geo M. Snyder, vice-president and general manager. Organized December, 1902, under laws of Delaware, with capitalization $1,000,000, shares $1 par; issued, $700,000. Lands, 11 claims, area 209 acres, also a 5-acre smelter-site, in the Lolo mining district. Development is by sundry test-pits, deepest 35′, and three short tunnels, longest 210′, showing melaconite, azurite, chalcocite, bornite and chalcopyrite. Company plans continuing development.

ALTA MINING & MILLING CO. **WYOMING.**

Office: care of P. E. Conley, secretary, 490 Quincy building., Chicago, Ills. Property is the Rawhide Butte group, in the Rawhide Buttes of Wyoming.

ALTAMONT MINING CO. **NEW MEXICO.**

Office: care of Capt. L. H. Williams, president, Altamont, Ills. Mine office: Jarilla, Otero Co., N. M. Lands include the Cuprite property, developed by a 140′ shaft, said to show 12′ of medium grade chalcopyrite, with

limestone gangue. Sample shipments to El Paso smelter gave returns of $10 to $50 per ton.

ALTA-PERUVIAN MINING & MILLING CO. **UTAH.**

Office: Springville, Utah. Mine office: Alta, Salt Lake Co., Utah. F. J. McAuliffe, president; T. R. Kelley, secretary and treasurer. Organized 1904 with capitalization $200,000, shares $1 par. Lands, 4 claims, in the Little Cottonwood district. Apparently no work in progress.

ALTA-QUINCY MINE. **UTAH.**

Mine office: Alta, Salt Lake Co., Utah. Alexander Colbath, superintendent. Lands, sundry claims opposite the Columbus Consolidated, opened by a tunnel cutting a 25′ fissure vein, with hanging-wall paystreak averaging 11% copper, 10 oz. silver and $2.80 gold per ton. Developments considered promising.

ALTA-ST. LOUIS MINE. **UTAH.**

Letter returned unclaimed from former mine office, Alta, Salt Lake Co., Utah. W. M. J. Craig, manager. Has a vein between limestone and shale carrying a 12″ to 18″ paystreak, giving assays of 15% to 25% copper and 15 oz. to 240 oz. silver per ton, with small gold values.

KONIGLICHES HÜTTENAMT ALTENAU. **GERMANY.**

Office and works: Altenau im Harz, Germany. Is a custom-smelting plant, treating ores of copper and other metals from the mines of the Hartz.

ALTENS KOBBERGRUBER. **NORWAY**

Office: care of Sulitelma Aktiebolag, Helsingborg, Sweden. Mine office Kaafjord, Finmarken, Norway. Emil Knudsen, chief director; Audr. Quale general manager; B. C. G. Tiberg, engineer; Sverre Falch, chemist and mill superintendent; R. Rusten and Gustaf Swensson, mine superintendents. Is the northernmost copper mine of the world, being located near North Cape, in 70° north latitude. Lands, 90 claims, patented, area 93 acres, also a 60-acre millsite and 2,000 acres miscellaneous lands, in the Kaafjord district. Property shows about 30 fissure veins of copper and iron pyrites, 12 of which are more or less developed, these averaging 10′ width and 3,000′ length, carrying ores averaging about 2% copper. Has 6 shallow shafts and 8 tunnels, seven crosscut and one in ore, these ranging from 150′ to 2,500′ in length, with a total of about 15,000′ of underground openings, exposing circa 600,000 tons of ore, with about 100,000 tons blocked out for stoping. Mine was opened 1821, closed 1873, and reopened 1895, by present owner. Mine is 300 miles from railroad, but only 300 feet from the sea, by which shipments are made and received. Equipment includes hoists, air and diamond drills, electric light, etc. Power is supplied by a Pelton wheel fed by a 1,000′ waterfall. The concentrator has 100 tons daily capacity. Annual production is about 30,000 tons of raw ore, which is concentrated into 2 grades, first averaging 12% copper, and second 4% copper and 50% sulphur. Property has an excellent management.

GEWERKSCHAFT ALTFALTER. **GERMANY.**

Mine office: Altwalnau, Hirschberg-Grossalmerode, Hessen-Nassau, Ger-

many. Has copper-lead ores, developed by one shaft, and employed about 30 men, at last accounts.

ALTO COPPER CO. **ARIZONA.**

Office: 43 Exchange Pl., New York. Mine office: Patagonia, Santa Cruz Co., Arizona. Geo. A. Beaton, president; Geo. O. Earhart, secretary; Geo. J. Lockley, treasurer; J. N. Curtis, general manager; J. J. Jones, mine superintendent; J. W. Prout, Jr., engineer. Organized April 4, 1905, under laws of Maine, with capitalization $3,000,000, shares $100 par. Bonds, $750,000, at 7%. Annual meeting, first Tuesday in April. Lands, 21 claims, area 420 acres, 8 miles from Patagonia, in the Santa Rita Mountains, near the Mexican border, developed by tunnels of 187′ and 400′ and by about 51 antigua shafts, of 30′ to 70′, and by 3 new shafts of 73,′ 100′, and 150′, with circa 3,000′ of underground openings, which are estimated by the company to show 500,000 tons of ore blocked out for stoping, which is unduly high. Ores give assays of 8% to 12% copper, 10% to 20% lead, 10 oz. to 30 oz. silver and $3 to $20 gold per ton, from chalcopyrite, associated with galena and sphalerite. Has a good steam power equipment, 3 hoists, good for 600′ each, 8-drill Sullivan air-compressor and 8 power drills. Has a 20x40′ machine shop, smithy, and about 25 miscellaneous buildings, including dwellings. Company reports that it is employing about 100 men, and operations seem to be conducted on a business-like basis. The ore, from its complicated nature, will prove refractory in reduction.

ALVERSTONE MINE. **CALIFORNIA.**

Mine office: Placerville, El Dorado Co., Cal. Was developing by tunnel early in 1906.

ALVERDSKI GROUP. **RUSSIA.**

Mine office: Alverdski, Bortschalo, Tiflis, Russia. It is said to be owned by a French syndicate. Is a new property of considerable promise, with vigorous management. Production, 1903, was approximately 2,000,000 lbs. fine copper, with promise of a considerable future increase.

AMADOR CONSOLIDATED MINING & DEVELOPMENT CO. **MONTANA.**

Office: 507–172 Washington St., Chicago, Ills. Mine office: Iron Mountain, Missoula Co., Mont. Joseph Sherlaw, president; D. E. Mackinnon, secretary; Robt. M. Mahler, treasurer. Organized March 16, 1903, under laws of Arizona, with capitalization $10,000,000, shares $5 par, as a reconstruction of the Amador Copper & Gold Mining & Milling Co., to secure additional funds necessary for development. Lands, 18 claims, area 355 acres, also 2 groups of patented placer-gold claims, area 180 acres, with 5 mill and smelter sites and 450 acres miscellaneous lands, showing 5 fissure veins in slates and quartzite, of which 3 veins, claimed to be of 40′ to 270′ width, are undergoing development, these giving oxide and sulphide ores, mainly chalcopyrite, with a little chalcocite, said to assay 3% to 34% copper, 3 oz. to 16 oz. silver and $6 gold per ton. Main ore body on the east drift of the 250′ level is claimed by company to be 1,325′ long and 35′ wide, with 10′ of sulphide smelting ore and about 20′ of fair sulphide concentrating ore. Main shaft is 400′ with tunnels of 187′ 512′, 632′, and 662′, estimated

by company to show 365,000 tons of ore blocked out for stoping. Has a 2-mile flume and pipe-line, delivering water at mine under a 310′ head. Has an air-compressor, 4 power drills, 2 hoists and 15 mine buildings and dwellings, and a sawmill. Company has refused for past 4 years to permit anyone but workmen to inspect its mine, hence information as to the large ore bodies rests solely upon the statement of the company, and its engineers, paid for official reports. Shipments of ore were began March, 1906, and it is to be hoped that hereafter the management will be able to make good its lavish promises of steady production and large dividends.

AMADOR COPPER & GOLD MINING & MILLING CO. **MONTANA.**

Reorganized, 1903, as Amador Consolidated Mining & Development Co.

GEWERKSCHAFT VER. AMALIA- UND KNOTTENBERG. **GERMANY.**

Letter returned unclaimed from former mine office, Mornshausen an der Dautphe, Hessen-Nassau, Germany. Adolph Freund, president; Paul Marcus, engineer. Capitalization, 1,400,000 marks. Has cupriferous silver-lead ores, opened by one shaft.

AMALGAMATED COPPER CO. **MONTANA.**

Office: 42 Broadway, New York. Henry H. Rogers, president; F. O. Addicks, vice-president; A. H. Melin, secretary and treasurer; John D. Ryan, managing director; H. H. Rogers, Albert C. Burrage, W. M. Rockefeller, H. H. Rogers, Jr., Fred P. Olcott, James Stillman, Anson R. Flower, J. D. Ryan, and Geo. H. Church, directors. Organized April 27, 1899, under laws of New Jersey, with capitalization $75,000,000, increased, 1901, to $155,000,000, shares $100 par. Central Trust Company of New York and National Shawmut Bank of Boston, registrars. National City Bank of New York and Kidder, Peabody & Co., of Boston, transfer agents. Annual meeting, first Monday in June.

The Amalgamated is a securities holding corporation, not a mining company, with assets consisting mainly of stock in sundry subsidiary companies. Stock of the following named corporations is entirely owned by the Amalgamated, with the exception of the few founders' shares, required to be in the names of directors: Washoe Copper Co., capitalization $5,000,000; Colorado Smelting & Mining Co., (Trenton), capitalization $2,500,000; Diamond Coal & Coke Co., capitalization $1,500,000; Big Blackfoot Milling Co., capitalization $700,000. In the following named corporations the Amalgamated holds from practically the entire issue, as in the case of the Boston & Montana, to a majority interest only, as in the Anaconda: Boston & Montana Consolidated Copper & Silver Mining Co., capitalization $3,750,000; Parrot Silver & Copper Co., capitalization $2,298,500; Butte & Boston Consolidated Mining Co., capitalization $2,000,000; Anaconda Copper Mining Co., capitalization $30,000,000. The Amalgamated also is credited with owning a controlling interest in the United Metals Selling Co., but in all likelihood the control is held by Amalgamated officers, rather than by the company. The Hennesy Mercantile Co., which was profitable but unpopular, was sold, 1904. Miscellaneous holdings of the Amalgamated include 27,000 acres of timber lands; a large stock interest in the Anaconda & Pacific

R. R. Co.; the Republic Sampling Works, at Butte; a sawmill at Ravalli, Hamilton county, Montana; hotels at Anaconda and Hamilton; business blocks in Butte and Anaconda, and several daily newspapers. One of the newspapers is highly profitable, but the others are not. The settlement of the Heinze fight probably will lead to the weaning of several subsidized journals.

The subsidiary mines and other enterprises of the Amalgamated employ circa 13,000 men, mainly at Butte, Anaconda and Great Falls, Montana, with an annual payroll of about $15,000,000.

The Amalgamated Copper Company was formed, in 1899, to control the copper industry of the world. Lamentable failure ensued in 1901, whereupon the management began, for the first time, to evince business ability, by learning the business that the company had engaged in, and stopping up the leaks. The material progress scored by the Amalgamated has been especially notable since John D. Ryan became managing director, in 1904. In two years Mr. Ryan has done much to strengthen the company's position. The Heinze war has been settled, the "company store" has been sold, the friendship of the employes has been retained and strengthened, and the Amalgamated has been made stronger in every direction.

The copper mines controlled by the Amalgamated are looking well, without exception. The settlement of the litigation with the Heinze forces will permit the working of a number of good properties tied up for years by injunctions. The Amalgamated's share of the production made by mines controlled by it somewhat exceeded 200,000,000 lbs. fine copper in 1905. This will be increaeed in 1906, and 1907 should show a further considerable gain.

The Amalgamated has been run as a close corporation, thanks to the laws of New Jersey, which permit the legal offspring of that state to conduct their affairs in any manner whatsoever, so long as the required taxes are paid regularly to the state. During the past year a more liberal tendency has been noted, and a financial statement—the first rendered—was given shareholders at the annual meeting of June, 1905. This, while good as far as it went, was entirely too much condensed to be satisfactory. It seemed too much like asking a hungry laborer to make a full meal off a maccaroon.

The "Story of Amalgamated," printed by Thos. W. Lawson, as a serial in Everybody's Magazine, cannot be accepted seriously by any person cognizant of the facts of which Lawson attempts to treat. The "Story" is merely a clever piece of fiction, so contrived that the author stands in the limelight throughout. The Amalgamated management made some very bad mistakes in the early years, and did some things for which the word "mistake" seems very charitable, but Lawson has so mingled fact and fiction that both are alloyed. The best disposal of the virtuous Lawson can be made by comparing his copper company with that of H. H. Rogers. The Amalgamated employs 13,000 men—Lawson's company, the Trinity, employs 3 men—and the Trinity was born but a few months later than the Amalgamated.

Earnings of the Amalgamated for 1905 probably were about $13,000,000, or a little better than $8 per share. Cost of producing copper was nearly

or quite one cent per pound less than two years previously, this alone representing an addition of about $2,000,000 to the profits. Earnings from other sources than copper mines probably were another $1,000,000. Dividends for 1905 were $6,975,000, as against $3,100,000 for each of the two preceding years. The high-water record was reached in 1901, with dividends of $11,625,000. In 1906 the dividends should be increased.

AMALGAMATED GOLD & COPPER CO. **ARIZONA.**

Dead. Was located at Huron, Yavapai county, Arizona, where a 300' shaft was sunk. Company was promoted by Douglas, Lacey & Co., a firm of swindlers maintaining sumptuous offices at 66 Broadway, New York, with about 40 branch offices in the United States and Canada, from which worthless mining stocks are peddled. The firm claims to operate on the law of averages, and, by handling many mines, to permit the good ones to make up for the failures. Considerable bluffing has been done in the way of crude mining operations, but these evidently were merely for the purpose of keeping up appearances. No mining company promoted by this firm ever has earned a profit, so far as can be learned. Dividends have been paid on shares when no profits have been earned, for which Douglas, Lacey & Co. should be jailed for common swindlers, and doubtless would be, were the laws of the United States administered solely with a view to justice.

Stock in worthless companies was exchanged for stock in equally worthless companies, whenever "investors" grew tired, and the victims of the conspiracy were tolled along on the "dividends" paid out of the money they themselves had furnished. Cash dividends have been suspended for several years, being replaced by "scrip" dividends. As far as can be learned, this firm has bilked about 20,000 small investors, including many widows and orphans, in the United States and Canada, out of several millions of dollars. It is understood that the firm is endeavoring to include England in its operations. There seems no reason to think that the English officials will be less complaisant than those of the United States, as the firm has money. By virtue of advertising in the financial and mining press of the United States, criticism has been forestalled, as there are comparatively few publications, of this class that are not edited from the business office.

In November, 1903, a formal complaint against this firm was lodged with the United States postal department, but nothing has come of the matter, despite repeated attempts to learn why the firm is not investigated. The postal department has shut out of the mails a number of small swindlers, but evinces no desire to restrict the operations of the big rascals. It is to be hoped that eventually Congress may decide to thoroughly investigate the postal department, and learn definitely what particular official, or officials, is in receipt of hush-money. This case has been called personally to the attention of Mr. Geo. B. Cortelyou, postmaster-general, but without results.

AMARILLA COPPER CO. **NEW MEXICO,**

Letter returned unclaimed from former office, Boston, Mass. Mine office: Jarilla, Otero Co., N. M.

capitalization $500,000, shares $1 par. Lands are mining rights to about 1,000 acres, and a 50-acre millsite owned in fee. Ore occurs as blanket veins between trap and shale, these having an average thickness of 2′ and being traceable nearly 4 miles, carrying an estimated minimum average af 2% to 2.5% copper, with small gold and silver values. Native copper occurs at depth, with various oxides and carbonates above, in a gangue of altered shale. Mine is opened by 3 inclines, of 155′, 450′, and 1,300′, and by a 500′ crosscut drainage tunnel. Has steam power, with 30-h. p. hoist, 5-drill Rand air-compressor and drills, tramway and necessary mine buildings. The concentrator is of wood and stone, with daily capacity of 50 tons, having 2 rolls, screens, crushers and 2 Wilfley tables. Product, when mine is operated, is turned out as concentrates, shipped to smelters on New York harbor. Idle for several years past.

AMERICAN COPPER MINING & EXTRACTION CO. **COLORADO.**

Office 828 Equitable Bldg., Denver, Colo. Owned the Gardiner copper leaching and precipitating process, in use at the Denver plant of the Union Ore Extraction & Reduction Co.; process since sold to the Commonwealth Reduction Co. Apparently owns no mining property.

AMERICAN COPPER MINING & MILLING CO. **UTAH.**

Letters returned unclaimed from former mine office, Simpson Springs, Utah.

AMERICAN COPPER MINING & SMELTING CO. **NEW MEXICO.**

A "fake," promoted by J. R. Kerr & Co., formerly at 555-11 Broadway, New York.

AMERICAN DEVELOPMENT CO. **ARIZONA.**

Succeeded, March, 1906, by American-Saginaw Development Co.

AMERICAN EAGLE COPPER MINING CO. **WYOMING.**

Letter returned unclaimed from former mine office, Encampment, Wyo.

AMERICAN EAGLES GROUP. **CALIFORNIA.**

Mine office care of A. L. Crew, Needles, San Bernardino Co., Cal. Lands, sundry claims, circa 40 miles south of Needles and 10 miles west of the Colorado river, on which a little work was being done by Needles parties, late in 1905.

AMERICAN FLAG MINE. **UTAH.**

Office: care of E. B. Palmer, secretary, Salt Lake City, Utah. Mine office: Park City, Summit Co., Utah. Capt. T. F. Singiser, president; John G. Rhodin, superintendent. Ores carry 1% to 2% copper, 4% to 6% lead, and up to 60 oz. silver and $7.50 gold per ton. A new and efficient hoisting plant was installed in 1905.

AMERICAN GOLD & COPPER CONSOLIDATED MINING CO. **ARIZONA.**

A tentative reorganization, circa 1905, of the American Copper Co., of Yavapai county, Ariz na.

AMERICAN GOLD & COPPER CO.

Office: 951 Tremont Bldg., Boston, Mass.

AMERICAN GOLD & COPPER CO. **ARIZONA.**

Office: 401 Henne Bldg., Los Angeles, Cal. Letter returned unclaimed from former mine office, Morristown, Maricopa Co., Ariz. J. J. Hawkins,

attorney. Capitalization $1,000,000, shares $1 par. Lands, circa 100 acres, including Fitzhugh Lee, Joe Wheeler and Eddy mines. Has auriferous and argentiferous copper ore, with considerable development, steam power and 10-stamp mill.

AMERICAN GOLD & COPPER MINING CO. **WYOMING.**

Office: 1431-79 Dearborn St., Chicago, Ills. Mine office: Jelm, Albany Co., Wyo. Albert L. Stone, president; J. C. Essick, secretary; Louis Miller, general manager. Capitalization, $5,000,000. Lands, 14 claims, held by location. Has slightly developed auriferous copper ores. Has a 5-stamp gold mill. Idle at last accounts, but management was endeavoring to secure funds to resume work.

AMERICAN GOLD MINING CO. **COLORADO.**

Office: 304-411 Olive St., St. Louis, Mo. Mine office: Ouray, Ouray Co., Colo. Employs 40 men. W. C. Wrisberg, president and general manager; Ernest P. Olshausen, secretary and treasurer; V. A. Laughlin, superintendent; Ed. Wall, mine superintendent. Organized 1889, under laws of Colorado, with capitalizaton $3,000,000, shares $10 par. Has paid dividends of $420,000. Lands, 13 patented claims, area 200 acres, including the American Nettie and West View mines, also a 50-acre millsite, in the Ouray district. Country rocks are granite, shale and quartzite. Produces oxide and sulphide ores averaging 2% copper, 1% lead, 20 oz. silver and 20 cents gold per ton. Has about 75,000′ of underground openings, with a large amount of ore blocked out and in sight. Has steam, electric and water power, with a 40-stamp mill and concentrator, shipping concentrates to the Pueblo smelter.

AMERICAN GOLD MINING COMPANY, OF NEW MEXICO. **NEW MEXICO.**

Office: 312 Tacoma Bldg., Chicago, Ills. Mine office: Nogal, Lincoln Co., N. M. A. T. Anderson, president; John Monk, secretary; J. M. Rice, manager; M. D. Gaylord, superintendent. Lands include the American, Helen, Old Abe and other mines, carrying ores of copper, gold, silver and lead. Has steam and electric power, with a 50-stamp mill and 50-ton cyanide plant.

AMERICAN-MEXICO MINING & DEVELOPING CO. **MEXICO.**

Office: 1018 National Life Bldg., Chicago, Ills. Mine office: San Lorenzo, Durango, Mex. Dr. W. S. Phillips president; H. E. Graham, vice-President; A. T. Grove, secretary and treasurer; G. E. Fitzgerald, general manager; John Dalton, mine superintendent; John Brady, smelter superintendent. Organized 1902, under laws of South Dakota, with capitalization $3,000,000, shares $1 par; issued, $1,267,544. Begun paying dividends of 2¼% monthly, in April or May, 1903, from stock sales, and president assures the Copper Handbook that to March, 13 1906, company had paid dividends of $357,318.34.

Mining lands are reported by company as approximately 3,000 acres, with a 1,500-acre smelter site, at San Lorenzo and an 805-acre smelter site at Torreón. Mines include La Roca Negra, Tecolotes and others. Company

claims to be developing 8 mineral bodies, averaging 3 meters width, showing ore averaging 2% copper, 7% lead, 30 oz. silver and $7 gold per ton. Has 5 shafts, deepest 350′, also 5 tunnels, of 500′, 800′, 1,000′, 1,200′ and 3,000′, estimated by company to show 150,000 tons of ore, with 60,000 tons blocked out for stoping. Company reports a 200-h. p. steam plant at the melter. Smelter, at San Lorenzo, 3 to 6 miles from the mines, is reported by Dr. Phillips to have furnaces of 50, 100, and 200 tons daily capacity. Press reports are that the 50-ton furnace was blown in during March, 1906. Product is a 15% matte. Production of company is reported as 261,531 lbs. fine copper in 1904, and approximately 300,000 lbs. fine copper in 1905.

La Roca Negra mine, sometimes called La Victoria, was bought of Carlos von Brandeis for $60,000. It is a good mine, but a small one, and its 3 veins average 6″ to 9″ width only, and not 3 metres. Its area is 10 pertenencias only—a trifle less than 25 acres.

Production during 1904 was at the rate of about one carload of very rich ore monthly, and it is impossible t see where the reported production of copper came from.

A. T. Benson, a shareholder, brought suit in a South Dakota court, and Thos. H. Null, of Huron, South Dakota, was appointed receiver for the company. Benson charges in his suit that the officers received 600,000 shares of stock without rendering an equivalent, and that they made large profits at the expense of the company by issuing options on treasury stock, at prices below those demanded by the company, and that dividends were paid from stock sales and not from earnings of the mine and smelter.

La Roca Negra is a good small mine, but the operations of the American-Mexico company have been regarded with deep and apparently well-founded suspicion, by mining men on the ground, and by others conversant with the company's operations. There seems no reason to change the unfavorable opinion of this concern expressed in the last issue of the Copper Handbook.

AMERICAN MINES DEVELOPMENT CO., LTD.

Office: 506 Oneida Bldg., Minneapolis, Minn. P. R. Bailey, president; Jas. T. Manning, secretary, treasurer and manager. Claims to own and to be developing copper, gold, zinc, lead and oil properties, but location of property, if any, is unknown, and company apparently is either a fake or a mistake.

AMERICAN MINING CO. **IDAHO.**

Letter returned unclaimed from former mine office, Weiser, Washington Co., Idaho.

AMERICAN MINING CO. **MEXICO.**

Mine office: La Cananea, Sonora, Mex. John H. Talbot, manager. Organized under laws of Colorado. Lands, 126 pertenencias, adjoining the Cobre Grande mine of the Greene Consolidated, with a strike of 4,000′ on the mineral zone. Main shaft is 250′ and located 200′ from the Cobre Grande workings. Also has 2 other shafts, one, the Republic, 175′, being 1,500′ west of the main shaft, on the parallel Veta Grande zone of the Greene Con-

solidated, with drifts in ore assaying 5.5% copper, 3.5 oz. silver, and $1.20 gold, per ton. Main shaft is said to show a 56′ vein of disseminated chalcocite, assaying 5.6% copper, 13.4 oz. silver, and $1.84 gold, per ton.

AMERICAN MINING CO. **UTAH.**

Said to have promising claims near Mineral Springs, about 15 miles northwest of Death Cañon, in the Deep Creek district, opened by a 180′ tunnel, from which several smelter shipments of ore of good grade were made during 1904. No later developments ascertained.

AMERICAN MINING & DEVELOPMENT CO. **MEXICO.**

Office: care of Duey & Overlock, Bisbee, Ariz. Chas. McHenry, superintendent. Lands, sundry claims, a few miles south of Naco, near the Arizona-Sonora border.

AMERICAN MINING, MILLING & SMELTING CO.

Offices: care of Weston & Co., 10, Coleman St., London, E. C., Eng. "James Reid," president and treasurer; "H. Reid," secretary; "W. Matthews," general manager. The American Mining, Milling & Smelting Co. is a rank swindle, incorporated under American laws, but feeding upon the guillability of the residents of Great Britain, where it is domiciled, under the wing of Weston & Co., a more than shady London concern. The company claims to possess mines in Alaska, Arizona, California, Colorado and Mexico. None of these alleged mines have been located. Formerly had a representatitve at 78 Wall St., New York, in the person of Wm. C. Hickman, a crooked promoter, who also ran a bogus rating agency, known as the Financial Mercantile Agency, which, for a consideration, reported favorably on fraudulent financial schemes. Hickman is under indictment and a fugitive from justice.

The financial press of Great Britain and the United States has been fully informed of the fraudulent nature of this concern, and it may be assumed, with entire safety, that any financial or mining journal puffing the shares of this utterly putrid concern is doing so for a cash consideration, knowing that it is taking hush-money at the expense of its deluded readers. As was stated last year, the American Mining, Milling & Smelting Co., is a swindle of the most rotten and bare-faced sort, and every man connected with it is either a fool or a rascal.

AMERICAN PROSPECTING & DEVELOPMENT CO. **ARIZONA.**

Office: Bisbee, Ariz. Mine office: Jerome, Yavapai Co., Ariz. Lands, sundry claims, adjoining the Equator mine. Has a 43′ shaft with a 112′ drift in ore.

AMERICAN QUEEN MINING CO. **COLORADO.**

Mine office: Gold Hill, Boulder Co., Colo. Property is the Cash mine, carrying ores of gold, silver and copper, latter a by-product of limited amount. Has a 25-ton mill, with 10 stamps.

AMERICAN-SAGINAW DEVELOPMENT CO. **ARIZONA.**

Office: 510 Lyceum Bldg., Duluth, Minn. Mine office: Bisbee, Cochise Co., Ariz. Thos. H. Collins, president; Chas. d'Autremont, Jr., vice-president; Frederick R. Kennedy, secretary; Wm. G. Haggart, treasurer; preceding officers, Henry B. Hovland, Wm. B. Mershon and Watts S. Humphrey, di

rectors; L. W. Powell, general manager. Organized March 7, 1906, with capitalization $1,000,000, shares $10 par, succeeding the American Development Co. and Saginaw Development Co. Stock was issued half to shareholders of each of the old companies, marked $3 paid, and a further assessment of $3 was levied shortly thereafter, payable $2 May 1 and $1 July 1, 1906, last call being to provide funds to meet payment of a balance of $209,710.20 due on the property. Lands, 26 claims, of which the American furnished 9 claims, lying next east of the Junction and Calumet & Pittsburg, and the Saginaw furnished 17 claims, area 297 acres, also favorably located, and including the Muheim and Worlds' Fair groups. Development is on the Saginaw group, which has an old 384′ shaft, sunk at an angle of 70° with the horizon, showing 35′ of leached ore on the 300′ level, and the new Saginaw 3-compartment 912′ shaft, which cut a 35′ body of low-grade ore on the 350′ level. The Saginaw shaft has a double-drum first-motion hoist, with capacity for raising 4-ton skips 1,400′, and also has a good pumping equipment. Management is excellent and property is regarded as well located.

AMERICAN SMELTERS EXPLORATION CO.

Organized early in 1905, and title changed soon thereafter to American Smelters Securities Co.

AMERICAN SMELTERS SECURITIES CO. **U. S. A. & MEXICO.**

Office: 71 Broadway, New York. Daniel Guggenheim, president; Barton Sewell, S. W. Eccles and Edward Brush, vice-presidents; G. M. Borden, secretary; Morris Guggenheim, treasurer; E. C. Palmer, general manager; W. S. Morse, assistant manager; W. C. Potter, Mexican manager; William R. Rust, business manager; Alfred von der Ropp, metallurgical superintendent. Organized March 25, 1905, under laws of New Jersey, as American Smelters Exploration Co.; name changed to present title May, 1905. Capitalization $77,000,000, shares $100 par, divided into $17,000,000 Series A cumulative 6% preferred stock, at $30,000,000 Series B cumulative preferred stock at 5%, and $30,000,000 common stock. Series A has preference as to dividends, and both preference series have equal rights as to assets, both having priority over common stock. The American Smelters Securities Co. is controlled by the American Smelting & Refining Co., through ownership of a majority of the issue of common stock, and the American Smelting & Refining Co. guarantees the Series B preferred stock. First quarterly dividend was paid July, 1905, on Series A. Morton Trust Co., registrar. Annual meeting, first Wednesday in September.

The American Smelters Securities Co. is merely a subsidiary corporation of the American Smelting & Refining Co., and in turn controls a number of smaller corporations, including the Guggenheim Exploration Co., Selby Smelting & Lead Co., Tacoma Smelting Co., Puget Sound Reduction Co., and others.

Among the mining properties controlled are the Silver Lake mines at Silverton, San Juan county, Colorado, which produce ores of gold, silver, lead and copper, and have steam, water and electric power, with a 400-ton concentrator, employing circa 200 men.

The Santa Maria y Anexas mines, at Velardeña, Durango, Mexico, have auriferous and cupriferous silver-lead ores, extensively opened. The mines have steam and gasoline power and a 500-ton smelter, employing about 600 men at last accounts.

The company also owns the Gibosa y Anexas mines, at Jiminez, Chihuahua, Mexico.

The Mina Tepezalá at Tepezalá, Aguascalientes, Mexico, has silicious silver-copper pyrites, opened by a 560′ main shaft. Has a good power plant and employs several hundred men.

The Dolores y Anexas, at Matehuala, San Luis Potosí, Mexico, include the Dolores, Trinidad, and Azul mines, employing about 500 men. F. J. Foster, superintendent; L. A. Roan, engineer. Lands, 93 pertenencias, area 230 acres. Veins occur as contacts between limestone and porphyry, carrying sulphide ores with garnetiferous gangue, returning an average of 7% copper, 3.8 oz. silver and $1.50 gold per ton. The San Miguel shaft is 600′ deep and the San Miguel tunnel is 1,500′ long, the mine having about 8,000′ of underground openings. Has gasoline power and is reached by the Porvenir de Matehuala railroad. Production, 1902, was 2,481,832 lbs. fine copper, from 17,756 metric tons of ore treated, giving an average return of 6.34% copper. Production, 1904, was 4,015,000 lbs. fine copper.

The works of the Selby Smelting & Lead Co., at Selby, Contra Costa county, California, include an extensive refining plant, with steam and electric power, drawing ore supplies from the Pacific coast and from some distance in the interior. The works of the Puget Sound Reduction Co., at Everett, Snohomish county, Washington, includes three 30x180″ blast furnaces, one of which runs on copper ores, making a 50% matte which is blown up to blister copper in a reverberatory furnace and shipped east for electrolytic refining. This plant is one of the two producers of arsenic in the United States, making about 5 tons of arsenic daily from Monte Cristo ores, at last accounts.

The plant of the Tacoma Smelting Co. includes an extensive and well-located site on tidal water, flats being reclaimed by filling in with slag. There are extensive wharves, with ore-bunkers and automatic unloading devices, a small electric tram-line connecting the wharves with all parts of the works. The smelting plant includes 4 lead stacks, 100-ton blast-furnaces, with three Connersville blowers driven by a 200-h. p. Westinghouse induction motor. The copper smelter include three 60-ton mechanical roasters, two 10-ton hand-roasters, and a 400-ton 42x160″ water-jacket blast-furnace, with forehearth 14′ in diameter and 4′ high, holding 60 tons of molten matte. A 36″ cupola remelting furnace, with outside settler, can treat 75 tons of 50% matte daily. The convertor department has two stands and six 72x100″ barrel-type shells, with a 30-ton electric crane.

The company is said to plan the construction of a 125-mile railroad from Valdez to the Bonanza mine, and also to plan erecting a copper smelter in the vicinity of Valdez. Company is said also to plan taking over important properties in the Bingham district, and elsewhere.

It is expected that earnings will exceed $5,000,000 yearly. The management of this company is strong, experienced and aggressive, and the corporation should be heard from to an increasing extent in the copper field during the years to come.

AMERICAN SMELTING & REFINING CO. NORTH & SOUTH AMERICA.

Office; 71 Broadway, New York. Works offices, at numerous addresses given hereafter. Daniel Guggenheim, president; Barton Sewell, Edward Brush, and S. W. Eccles, vice-presidents; W. E. Merriss, secretary; Isaac Guggenheim, treasurer; August Raht, mechanical engineer. Organized April 4, 1899, under laws of New Jersey, with capitalization $54,600,000, increased to $100,000,000, in $50,000,000 cumulative 7% preferred and $50,000,000 common stock. For the fiscal year 1900, net earnings were $3,524,961, equal to nearly 6.5% on the then capitalization of $54,800,000. In 1904 net earnings were $7,905,573, and for fiscal year ending April 30, 1905, net earnings were $8,898,811, or nearly 9% on the present capitalization. Pays dividends of 7% on both common and preferred stock. To October, 1905, has paid dividends of $10,875,000. Controls the American Smelters Securities Company, through ownership of $17,751,000 of the common stock issue of $30,000,000, and owns 25,000 shares, par $2,500,000, of Series B preferred stock of the same company, bought for $2,302,270, and has guaranteed 5% dividends on the entire issue of $30,000,000 Series B preferred stock of the American Smelters Securities Co.

In addition to various smelting plants and stock interest in the American Smelters Securities Co., the American Smelting & Refining Co. also owns the exclusive rights to the Huntington-Heberlein ore-roasting patents in the United States and Mexico. A profit-sharing fund is maintained for employes occupying positions of responsibility, this fund, which is rapidly growing, amounting, September 1905, to $216,815. Company ended fiscal year 1905 with a surplus in cash and quick assets of $6,458,720.

The company has smelting plants with an annual capacity of approximately 5,000,000 tons of raw ore and concentrates. Principal reduction works are as follows;

Murray Smelter, at Murray, Salt Lake Co., Utah. R. D. Rhodes, superintendent. Has steam and electric power, with daily capacity of nearly 2,000 tons, employing about 1,000 men.

Germania Lead Works, at Salt Lake City, Utah.

Hanauer Smelting Works, at Salt Lake City, Utah.

United States Smelter, at Helena, Montana.

United States Smelter, at Great Falls, Montana.

Omaha Smelter, at Omaha, Neb.

Grant and Globe Smelters, at Denver, Colo. Franklin Guiterman, manager; H. H. Alexander, superintendent.

Pueblo Smelting & Refining Works, Pueblo, Colo. Geo. A. Harsh, superintendent.

Philadelphia and Pueblo Smelters, Pueblo, Colo. W. H. Howard, superintendent.

San Juan Smelter, Durango, Colo.
Bi-Metallic Smelter, Leadville, Colo.
Pennsylvania Lead Smelter, Salt Lake City, Utah.
Pennsylvania Smelter, Pittsburg, Kans.
Chicago & Aurora Smelter, Aurora, Ills.
Chicago & Aurora Smelter, Leadville, Colo.
Kansas City Smelters, Kansas City, Mo.
El Paso Smelter, El Paso, Texas, F. C. Earle, superintendent.
Guggenheim Smelter, Monterey, N. L., Mexico.
Guggenheim Smelter, Aguascalientes, Agsc., Mexico. Has two 300-ton convertible furnaces, used interchangeably on copper and lead ores.
El Carmen Smelters, Sierra Mojada, Chihuahua, Mexico.
Playa Blanca Smelter, Antofagasta, Chili, leased from the Compañía Minera Huanchaca.

Through control of the American Smelters Securities Co., the American Smelting & Refining Co. controls smelters on San Francisco Bay, on Puget Sound and at Velardeña, Durango, Mexico.

The Garfield Smelter is being built at Garfield Beach, on Salt Lake, not far from Salt Lake City. This will have a daily capacity of 2,000 tons, and will cost, complete, upwards of $1,500,000. It should be blown in during 1906.

A new copper and lead smelter in Chihuahua is said to be planned.

The Guggenheim Refinery, at Perth Amboy, N. J., was built in 1895 and has been greatly enlarged at various times since. This plant has the advantages of tide-water in front and rail connections at the rear. The works include copper and lead furnaces and a large electrolytic plant. There also is a bluestone plant, which makes large quantities of copper sulphate. The refining capacity of these works will be brought up to 60,000,000 lbs. of copper yearly, during 1906.

During 1905 the American Smelting & Refining Co. turned out from its various works 72,952,000 lbs. fine copper, rendering this concern one of the most important copper producers of the globe. As the management is highly skillful and aggressive, and the best technical and business talent is engaged, regardless of cost, it is obvious that the American Smelting & Refining Co. will become an increasingly important factor in the world's copper trade.

AMERICAN ZINC EXTRACTION CO. **ARIZONA.**

Mine office: Tucson, Pima Co., Ariz. Lands include the San Xavier mine, carrying ores of silver, lead and copper. Has steam power. Idle.

SOCIEDAD MINERA LA AMISTAD. **SPAIN.**

Office: San Antonio, 44, Granada, Spain. Mine office: Albuñuelas, Granada, Spain. Don Joaquin Marin Robles, president. Property is the Santa Ines mine, carrying copper and cobalt ores.

AMMAN-CRAWFORD MINES. **ALASKA.**

Mine office; Valdez, Alaska. Said to have been purchased, late in 1905, by New York and Michigan men.

AMPARO MINING CO, **MEXICO.**

Office: 815 Drexel Bldg., Philadelphia, Pa Mine office: Etzatlán, Jalisco,

Mex. Chas. K. Smith, president; Richard J. Oellers, treasurer; John R. [illegible] liams, secretary; Ferdinand Sustersic, general manager. Organised [illegible] with capitalization $3,000,000, shares $1 par; said to plan reduct[illegible] capital to $2,000,000. Lands include sundry mining properties, also Rancho Embocado, area 4,390 pertenencias. Property includes the C[illegible] mines, unwatered late in 1905, La Union gold-silver mine, and the San [illegible] Natividad and Amparo mines, lying seven to nine miles south of E[illegible] Principal property is the San Domingo mine, one of the earliest opened [illegible] district, which was worked to a depth of nearly 800′, ore and water [illegible] carried up 500′ of ladders on the backs of peons. The San Domingo shaft [illegible] be cut down to three-compartment size, and the mine is being opened by a [illegible] tunnel, which will give 500′ of back. Shaft below the tunnel is to be equ[illegible] with pumps and hoist. Company estimates 340,000 tons of high grade m[illegible] ore on the dumps, stopes, and unbroken in the mine. Ores are highly all[illegible] sulphides of lead, copper, silver and zinc, with good gold values, latter o[illegible] sionally reaching $40 per ton.

Equipment includes a 30-ton experimental plant, with Bryan mill, con[illegible] trating table and cyanide tank. It is planned to build a railroad from the [illegible] Domingo mine to Ahualulco, on the Mexican Central, the nearest railroad p[illegible] At close of 1905 company was milling about 30 tons daily, and shipping one [illegible] load daily of smelting ore to Torreón. During last six months of 1905 comp[illegible] paid $160,000 on note and mortgage, leaving $70,000 total indebtedness at [illegible] of year, and began 1906 with substantial earnings, estimated by interested p[illegible] ties at $100,000 monthly. Company plans beginning payment of divid[illegible] before close of 1906.

AMY C. MINE. COLORA[illegible]

Mine office: Idaho Springs, Clear Creek Co., Colo. John Owen, own[illegible] Ores carry gold, silver, lead and copper. Has steam power.

AMYGDALOID MINE. MICHIGA[illegible]

Sold, 1905, to Calumet & Hecla Mining Co.

ANACONDA CONSOLIDATED COPPER MINES AND SMELTING WORKS. AUSTRALI[illegible]

Property sold to Murrin Copper Mines, Ltd.

ANACONDA COPPER MINING CO.

Office: 9 Jackson Boulevard, Chicago, Ills.

ANACONDA COPPER MINING CO. MONTANA

Office: 42 Broadway, New York. Mine office: Butte, Silver Bow Co. Mont. John D. Ryan, president and general manager. Henry H. Rogers, vice president; preceding officers, A. C. Burrage, Wm. Rockefeller, Wm. G. Rockefeller, E. C. Bogert and W. W. Dixon, directors; C. F. Kelley, secretary; A. H. Melin, assistant secretary; John Gillie, general superintendent; E. [illegible] Mathewson, mill and smelter superintendent; D. W. Brunton, consulting engineer; J. P. O'Neill and James Higgins, mine superintendents.

Is controlled, through ownership of majority of stock, by the Amalgamated Copper Co. Organized June 18, 1895, under laws of Montana, with capitalization $30,000,000, shares $25 par, as successor of the Anaconda Mining Co.,

close corporation that formerly owned the mine, and which was controlled by Jas. B. Haggin, the late Marcus Daly and Senator Hearst. Annual meeting in May. Transfer agent, National City Bank, New York. Stock is listed on the London, Boston, New York and New York Consolidated stock exchanges. Dividend coupons are payable in England by the London Joint Stock Bank, Ltd., Princes Street, E. C. Warrants to bearer issued in denominations of 5, 20 and 50 shares. Dividends were $4,800,000 in 1900; $3,900,000 in 1901; $1,200,000 each in 1902, 1903 and 1904, and $2,400,000 in 1905. Total dividends of present company, for 10½ years to end of 1905, were $21,600,000. Net earnings for 1905 were nearly $5,000,000 from the mine, and nearly $6,000,000, including all miscellaneous net revenues. Company closed 1905 with a surplus probably exceeding $10,000,000, and possibly reaching $12,000,000, presumably in cash or its equivalent.

The Anaconda is the largest copper producer of the world and employs about 5,000 men, under normal conditions.

The Anaconda mine was opened as a silver property in 1880. At a depth of about 150′ the silver values decreased, being succeeded a little lower down by high grade copper ores, mainly chalcocite and bornite. At depth there is considerable enargite. The immense earnings of the mine during the fifteen years 1880-1894, are unknown, but may be estimated safely as not less than $50,000,000.

Lands, 572 acres, being much the largest property in the Butte camp, and including, in addition to working mines, a considerable number of idle properties, and a vast acreage of undeveloped lands of prospective value. The company has nearly 400 acres between the Anaconda mine proper and the North Butte, which bids fair to prove immensely valuable. Miscellaneous real estate holdings include sundry timber lands and coal mines.

The country rock, known as the Butte granite, is basic, with an intrusive acid rock known as the Bluebird granite, a quartz-porphyry being the third rock of the series in age, the entire rock mass being shattered by fissures carrying argentiferous and auriferous copper ores. The ores are mainly sulphide, largely chalcocite and bornite, with some chalcopyrite and a large percentage of enargite, the ores having a gangue of quartzite and decomposed country rock. The oxide and carbonate ores usually found near surface in copper mines are not frequent in the Butte district, the granitic country rock being unfavorable to their formation. Like the veins of all other known mining fields, the Butte ores have grown leaner with depth, but the lowest openings show ore bodies of great persistence and strength, carrying enormous quantities of disseminated ores running 2% to 6% in copper, and high grade chalcocite was found in a big vein at a depth of 2,100′ in 1905. Sufficient medium and low-grade ore is developed to enable the Anaconda to produce 75,000,000 to 100,000,000 pounds of refined copper annually for many years to come. A considerable number of stopes of high-grade ore remain untouched. Ores smelted give an average return of about 65 lbs. of copper per short ton, or 3.25% copper, with 3 oz. silver and average values of $1.75 to $2 gold and silver per ton.

The Anaconda mine proper employs about 700 men, and has a 3-com-

partment main shaft 2,450′ deep, timbered with 10x10″ square sets, with good ventilation and about 30 exits, connected underground with the Never Sweat, St. Lawrence and Bell mines. The mine has electric lights and electric signal bells. Hoisting is by 8-ton skips swung under double-deck cages and worked in counterbalance.

The Never Sweat mine employs about 500 men, and has a 3-compartment 2,440′ main shaft, retimbered 1905 with false sets, allowing 18″ play for squeeze. Square-set timbering is used, with back-filling. Tramming is done by horses. Mine has electric bells and lights and is connected underground with the Parrot, Colusa-Parrot and Moonlight mines. Hoist has 30x72″ cylinders, of 3,000-h. p., and raises 8-ton skips swung under double-deck cages.

The St. Lawrence mine employs about 500 men and has a 3-compartment 2,400′ main shaft, connected underground with the Mountain View, Pennsylvania, Anaconda, and Never Sweat mines, with 22 exits. Has a chain system of endless-haulage on the 14th level, and is equipped with electric signal bells and electric lights. The St. Lawrence mine has been on fire since 1890. This fire is in an extensive area above the 300′ level, and is fought constantly, and to retard its spreading, solid masonry bulkheads are built to cut off its progress. A complete fire-fighting brigade is kept constantly on duty, working regular 8-hour shifts. The mine water of the St. Lawrence carries 9 to 13 lbs. copper per ton, and part of the copper contents are precipitated underground on scrap-iron, in concrete sumps, and the water is again leached on surface, which it reaches carrying only 2 to 4 lbs. of copper per ton. The hoist has 32x72″ cylinders, raising 9-ton skips swung under double-deck cages.

The High Ore mine employs about 250 men and has a 3-compartment main shaft 2,300′ deep. This mine has 7 powerful pumps, 3 stationed on the 1,000′ level, 2 on the 1,600′ level, and 2 on the 2,300′ level, latter caring for the bulk of water from the Anaconda, Parrot and Washoe mines. Capacity of the High Ore pumping plant is equal to raising 4,000 gallons per minute from a half-mile depth. Water from the High Ore pumps goes to a big precipitating plant in the gulch back of Meaderville.

The Diamond mine employs about 250 men, and has a 2,200′ main shaft.

The Mountain Consolidated mine employs about 200 men, and has a 2,200′ main shaft.

The Green Mountain mine employs about 200 men, and has a 2,200′ 3-compartment main shaft.

The Bell employs about 350 men and has a 3-compartment main shaft 1,600′ deep, connected underground with the Anaconda. Ore is trammed by mules. Hoist is 28x40″, and raises double-deck cages.

The Sunnyside, Wild Bill, Gallatin, Buffalo, and Wake-up-Jim are among the smaller mines operated by the company. The Modoc mine, which is idle, has millions of tons of 1.5% to 2% copper ore, which cannot be worked profitably at present, but which doubtless will be utilized within the next few decades.

Electric power is used extensively. The generating plant is at Canyon Ferry, 70 miles distant, and the current is wired to the mine with a primary voltage of 50,000, reduced to 2,000 volts at the transformer station, just outside of Butte, power being distributed to the various shafts and buildings from a main station at the Never Sweat. The principal dynamo is of 800-h. p., and drives a large duplex air-compressor. A three-phase dynamo, driven by the Canyon City current, furnishes the motive power for a direct-current generator that replaced an extensive underground haulage plant actuated by compressed air. Many electric lights are used underground, being employed wherever possible. A large number of minor motors at the various buildings of the surface plant are driven electrically, using a 440-volt current. At the Never Sweat is a large compressor plant, with 5 Ingersoll-Sergeant air-compressors, actuated by steam and electric power, having a combined capacity to run 360 power drills.

Although title to the reduction plant stands in the name of the Washoe Copper Co., it is described at length in this article on the Anaconda, because it treats mainly Anaconda ores, is commonly known as the Anaconda smelter, and is leased by the Anaconda company. This monstrous plant occupies a site of 225 acres on Washoe Heights, in the outskirts of the city of Anaconda, 35 miles by rail from the mines, and was planned by Frank Klepetko, and built and equipped with the able assistance of Messrs. Repath and Gulberg, and the late Messrs. R. G. Collins and Wm. F. Evans. Ground was broken May, 1900, and smelting begun February, 1902. The plant has an actual capacity of nearly 10,000 tons of raw ore daily, and has no peer in the world. Its monstrous size is shown by the material required in its construction, this including 20,000 tons of structural steel, 50,000 cubic yards of masonry, 25,000,000 feet of lumber and 1,000 carloads of brick, in addition to 300,000 cubic yards of excavation.

The concentrator covers 7 acres and is built on stone foundations, in two parts, each 255x355′, connected by a power-house between. Each part contains 4 complete sections, and a description of one section gives a description of the entire concentrating plant, when multiplied by eight. Each section has one 24x24″ Blake crusher, reducing ore to 3″ size, this passing over two sets of trommels for sizing, oversize material going through two 5x15″ crushers, which reduce it to 1½″ size. Two belt elevators take the material on the main sizing-floor to a series of trommels for coarse sizing, oversize going to coarse jigs, which produce coarse concentrates for the blast-furnaces. The waste from the coarse jigs goes to two sets of 15x40″ rolls for crushing, and is thence elevated and rejigged. In the jigging department all undersize material from the crushers is treated automatically. Each jigging section has 36 double Evans jigs, set in three double rows, with Evans hydraulic classifiers, making three sizes of concentrates, which go to the storage bins, while the middlings go to the middlings department, which has two sets of 15x40″ rolls, crushing material to about 1¼″ size, which goes by belt elevators to 4 sets of trommels, from which the undersize goes automatically to 4 hydraulic classifiers which feed 18 double Evans jigs, set in

a triple row. The process is the same as in the jigging department and the concentrates from the middling department are mixed with the concentrates from the jigging department and go thence to storage bins. The middlings are collected in launders and taken by elevators to the regrinding department, which has four 5′ Huntington mills, 18 double Evans jigs and 4 hydraulic classifiers. The Huntington mills are fed from V-shaped tanks, the ground material passing through 1¼″ screens to hydraulic classifiers, thence to the jigs, both concentrates and tailings being car ied by water in launders and elevators. The slimes department has 35 Wilfley tables, fed from the bottom of V-shaped tanks, concentrates going to storage bins, 24x650′ and 70′ high, in two sets of upper and lower bins. The concentrator also is supplied with slum ponds, and a Lake Superior steam stamp is being installed for treating certain grades of ore. The Anaconda's concentrating ore carries an average of 4% copper, 1 oz. to 6 oz. silver and 0.01 oz. to 0.02 oz. gold, 16% iron oxide, 17% sulphur and 55% silica. The tailings carry an average of 0.8% copper and 90% silica.

The sampling mills, 42x60′ and 5 stories high, are of brick and wood, in 2 double sections, with a daily capacity of 600 tons each, equipped with Brunton samplers giving a final sampling of 3.2 pounds from each short ton of ore.

The roasting department is of steel, on stone foundations, 98x320′, with a heigh of 50′ from ground floor to calcining floor. This building contains 88 McDougall calcining furnaces, each 28′ high and with 6 roasting hearths and 3 patforms, hopper-cars delivering concentrates to hoppers with automatic feeds, each roaster having a daily capacity of about 40 tons. No coke is required except for the preliminary heating, the sulphur furnishing all fuel required after the charge is thoroughly ignited. Each furnace has an automatic discharge into two storage hoppers, these keeping the calcined ores hot until taken out to reverberatory furnaces. The building has sheet-iron flues that take the fumes into a dust-chamber 40x300′ and 40′ high, this having concrete inner walls and a floor of steel hoppers.

The power-house of the concentrator plant, 136x150′, standing between and connecting the two halves of the concentrator building proper, is of steel, with brick walls, having three 15-ton traveling cranes of 44′ span; and contains a 500-h. p. Allis-Chalmers engine and two triple expansion 2,000-h. p. Nordberg engines, the latter using rope transmission. The boiler-room contains ten 300-h. p. Stirling water-tube boilers, heated by waste gases from the reverberatory furnaces, effecting a very large fuel saving

The electric plant includes two 700-kilowatt 2-phase Westinghouse generators, one 500 kilowatt generator and three 125-arc-light generators, the latter furnishing light for the city of Anaconda as well as for the plant. It is planned to take power, before the close of 1906, from the Missouri river, near Helena, nearly 100 miles distant. The new plant will include a dam near Helena, and four 40-ton induction motors, to transmit a current of 70,000 volts. The new installation will cost approximately $500,000.

The reverberatory furnace building is of steel, 184x518′, and contain

28 furnaces, each 24x54′, set in two rows. Each furnace, of 120 tons daily capacity, has five charging hoppers, and one coal-hopper, fed from hopper-cars, the feeding of both fuel and calcined ore being strictly automatic. The matte is drawn off into 20-ton ladle cars and taken to the converter. The slag is skimmed into boxes overflowing into running water, and the granulated slag is washed through launders to the slag-dump. Fumes from the reverberatories are taken through underground flues, one for each row of furnaces, to the main flue. Fines are no longer reduced in blast furnaces, which smelt coarse ores only. Neither is flue-dust briquetted, but is treated in reverberatories with fines, and the waste gases used for steaming purposes. This plan adds about one-third to the normal smelting capacity of the blast furnaces, and reduces fuel charges nearly or quite one-third.

The blast furnace department is a 3-story steel building, 82x200′, the first floor carrying the railroad tracks, while the second story is the main operating floor, and the third is the charging floor. There were five furnaces, each 56x180″ and 40′ high, with a daily capacity of 400 tons each, but the largest furnace on record has been made by adding a new section between two of these furnaces, making one new furnace 56x500″. The capacity of the new furnace is about 1,600 tons daily, an increase of 300% in capacity with an increase of only 177% in size. Cupolas are made of cast iron plates, bolted, with 12 special water-jackets hung from steel beams, each furnace having 32 five-inch tuyeres. The charging floor has railroad tracks on each side of the furnaces, side-dumping hopper-cars being handled by compressed-air locomotives. The charging doors of the furnace extend full length, and are opened and closed by compressed-air pistons, and all charges are fed automatically. In front of each furnace is a 16′ settler, receiving a continuous flow of molten matte and slag, the matte being drawn from the bottom into 20-ton ladle cars, and taken thence to the converters. The slag overflows into sluices and after granulation by water is washed to the slag-dumps. Overhead sheet-iron flues carry off fumes and smoke into a dust-chamber which is an exact duplicate of that in the calcining department. The product of the first fusion is a 44% matte, and the slags carry an average of 0.2% copper only.

The converter building is 137x416′, of steel, with two 60-ton electric traveling cranes of 60′ span each, for handling converters and ladles, and two smaller electric traveling cranes for the converting and casting departments. There are 2 reverberatory storage furnaces for the receipt of matte from blast furnaces, these being available for smelting, if desired. There are 8 stands of converters, each shell being 8′ in diameter and 13′ long, with eighteen 1¼″ tuyeres and ball-closing valves. There are devices for tilting the shells in stands, and cranes for handling them when out of stands. The converters blow off into hoods with flues leading to a dust-chamber similar to those already described. The matte is blown up to a low-grade blister copper, and poured into ladles carried by cranes to three 70-ton casting-furnaces, which turn out anodes assaying about 97% copper and 80 oz. silver per ton. The anode moulds are on traveling carriages, actuated by hydraulic power, pigs going automatically to water-cooling tanks, while the slag goes to a casting machine and is made into

slag-brick. The lining department has a full outfit of machinery, largely auto-matic, for mixing linings for the converters, and these linings are tamped in place by ingenious machinery especially devised for the purpose. In 19[illegible] low-grade silicious ore was substituted for barren silica in converter lining, effecting a saving estimated at $600 per day, or about $180,000 per annum.

The briquetting department has two 100-ton presses, with dryers and con-veyors, but the only material now briquetted is slimes.

Blister copper from the Washoe smelter is sent east for electrolytic refin-ing, and makes a product assaying 99.5% copper, with traces only of arsenic and antimony, notwithstanding the large quantities of these deleterious ele-ments originally associated with the copper in the ore.

The power-house of the smelting department, 80x500′, of steel and brick, has a 15-ton electric traveling crane of 500′ reach. The boiler-house has eight-een 300-h. p. Stirling boilers and about 4,000 h. p. is generated from the waste gases of the reverberatory furnaces, effecting an enormous saving in fuel cost and stoking charges. There is a Nordberg triple expansion engine, with capacity to compress 20,000 cubic feet of free air per minute to a pressure of 15 pounds per square inch, also 4 Nordberg compound engines direct-connected with Connersville blowers having capacity to compress 30,000 cubic feet of free air per minute, delivered to the blast furnaces at a pressure of 2 pounds per square inch. There also are 3 smaller compressors, for locomotives and air-lifts. The plant is served by compressed air locomotives, charged at an initial pres-sure of 900 lbs. per square inch.

The smelter formerly discharged into the air daily about 2 tons of arsenic and scores of tons of sulphur, causing much trouble to the ranchers in the Deer Lodge valley. The Anaconda paid damages exceeding $150,000 in settling law-cases, and to obviate depopulating this fertile valley erected a new flue and smokestack in 1903. This stack, 300′ high, has an inside diameter of 33′ 4″ at the bottom and 30′ at the top, built of 3,000,000 brick, and is 4′ 6″ thick at the bottom. Connecting the smelter and stack is a flue 60′ wide and 36′ high, 2,170′ in length, and 5,500′ long with connections, under which is a tunnel 10′ high and 55′ wide. The trouble from arsenical sulphur fumes, while not abso-lutely overcome, has been greatly mitigated by the new flue and stack, and incidentally the improvement has proven an excellent thing for the company, about 175 tons of flue-dust being secured daily, of which about 60 tons are treated in a special arsenic refinery, the residue being re-smelted after the extrac-tion of its arsenical contents. As the waste fumes from the big stack carry off enough sulphur to make about 2,000 tons of H_2SO_4 daily, a sulphuric acid plant would seem to be a logical addition to this, the world's largest and most perfect metallurgical plant. Despite the efforts of the Anaconda to cease injuring the ranchers, suits for damages continue. There is good reason for thinking that this has become an established industry, but the courts are justly refusing to award big damages to ranchers who can prove no particular injuries, and whose markets—and excellent markets at that—are made by the works of the company they are endeavoring to extort tribute from. The Anaconda is not

the only American copper mining corporation that has been systematically bled, by alleged agriculturists and ranchers.

The copper refinery of the Washoe plant was closed August, 1903, since which time all refining has been done on the Atlantic seaboard, by the Baltimore Smelting & Refining Co. The Washoe plant, in addition to Anaconda ores, now treats the production of the Parrott, Butte & Boston, Washoe and Trenton companies of the Amalgamated Copper Co., and also handles the large tonnage of the North Butte, and in April, 1906, was treating nearly 10,000 tons of raw ore daily.

The Anaconda company operates a coal mine at Belt, Cascade county, Montana, F. W. C. Whyte, superintendent, which employs about 350 men The company also owns a controlling interest in the Butte, Anaconda & Pacific Railroad, 35 miles in length, and operates a sawmill and other extensive enterprises subsidiary to the mining and smelting of copper, among these being a big brickyard at Anaconda, which turns out enormous quantities of building, silica and fire-clay bricks, for the company's use.

For many years, with the exceptions of 1904 and 1905, the Anaconda has been the world's largest producer of copper, and the second largest producer of silver. For the Montana mining year ending June 1, 1905, the Anaconda reduced 1,473,644, short tons of ore, the largest tonnage on record. securing an average of $9.36 per ton thereform, the smallest returns on record. Gross income was $13,787,343, and net earnings aggregated $2,259,694, an average of but $1.53 per ton of ore treated, equal to 2.35 cents per pound of fine copper. But for the advantage of the new Washoe works, the Anaconda profit would have been only one-third the amount actually realized. The savings effected by the Washoe plant may be estimated safely at $1.25 per ton of ore treated, equivalent to but a trifle less than 2 cents per pound of fine copper produced.

For the calendar year 1905, Anaconda's production of ore was practically 95,000,000 lbs. fine copper. The management of the Anaconda is good, and the property is being handled intelligently and successfully.

ANACONDA MINE. **NEW MEXICO.**

Mine office: San Pedro, Santa Fé Co., N. M. Carruthers & Field, owners and managers. Ores carry gold, silver, lead, copper and zinc, Has steam power and is said to have a small smelter. Presumably idle.

ANACONDA MINING CO. **MONTANA.**

Parent of the Anaconda Copper Mining Co., and still in existence.

ANACONDA PROPRIETARY COPPER, GOLD & SILVER MINE. **AUSTRALIA.**

Succeeded by Melrose Copper Mines.

ANACONDA-SONORA COPPER CO. **MEXICO.**

Office: 159 La Salle St., Chicago, Ills. Mine office: Sahuaripa, Sonora, Mex. Employs 37 men. Ira McCord, president; Chas. F. DeWitt, vice-president; Wm. S. Barbee, secretary and treasurer; Jacob J. Smith, general manager; preceding officers and John L. Zachrias, directors; Wm. A. Morley, mill superintendent; Chas. Smith, smelter superintendent. Organized Mar. 17, 1906,

under laws of South Dakota, with capitalization $3,000,000, shares $10 par. Lands, 40 hectareas, also a 40-hectarea millsite and about 1,000 hectareas timber lands. Mining tract shows two ore bodies, said by company to range 8′ to 90′ in width and to show native copper, carbonates, chalcocite and chalcopyrite, averaging 17.5% copper, 19 oz. silver and $3.20 gold per ton. Development is by a number of short tunnels, aggregating 756′, estimated by company to give 100,000 tons of ore blocked out for stoping, which is impossible. Company reports a smelter in process of construction, on the Yaqui river, 9 miles from mine, to have two 60-ton water-jacket blast-furnaces. A branch of the Southern Pacific from Guaymas will pass within 9 miles of the property, and a wagon road is to be built between the smelter and the mine. It is also planned to develop water-power on the Yaqui river, and to construct an electric tram from the river to the mine.

ANCHORIA COPPER MINING CO. **WYOMING.**

Office: care of H. O. Granberg, secretary-treasurer, Oshkosh, Wis. Mine office: Copperton, Carbon Co., Wyo. Employs 8 men. D. H. Craig, president; E. M. Sanders, superintendent; Frank Earle, consulting engineer, Organized April, 1901, under laws of Wyoming, with capitalization $1,000,000, shares $1 par. Lands, 4 claims, area 82 acres, patented, in the Battle Lake district, developed by a 200′ shaft and tunnels of 45′ and 60′, showing an ore body estimated at 45′ width, giving average assays of 17% copper and from a trace to $5 gold per ton. Has a 40-h. p. steam plant, with hoist good for 500′, 3 power drills and 4 substantial mine buildings, of logs. A 250-ton smelter is planned to be built near the Anchoria by the Stemp Springs Coal & Power Co.

ANDERSON GROUP. **CALIFORNIA.**

Anderson & Co., owners. A group of 26 claims, with vein 2′ to 6′ wide, carrying argentiferous copper ore, in Riverside county, California.

ANDERSON MINING CO. **BRITISH COLUMBIA.**

Mine office: Alberni, Vancouver Island, B. C. J. C. Anderson, president. Has steam power and limited mining development. Idle.

ANDES COPPER MINING & EXPLORATION CO., LTD. **CHILE.**

Offices: 4, Sun Court, Cornhill, London, E. C., Eng. Wm. B. Brodrick, chairman; W. E. Singer, secretary. Capitalization £100,000, shares £1 par, issued, 6,707 shares, 10s. paid. Property is sundry mining lands in Tarapacá, Chile. Idle.

SOCIEDAD BENEFICIADORA DE MINERALES ANDINA. **PERÚ.**

Mine office: Yauli, Junin, Perú. Has silver-copper ores.

MINA ANDUEZA. **ARGENTINA.**

Owned by Sociedad Francesca de Minas y Fundicion de Nonogasta.

ANGANG COPPER CO. **MEXICO.**

Mine office: Chirangangueo, Zitacuaro, Michoacán, Mexico. Stock issue supposedly owned by Arimex Copper Co., a short-winded promotion by Thomas W. Lawson. Has a large body of medium-grade chalcopyrite, with a limited amount of development. Idle.

COMPAÑIA METALURGICA DE ANGANGUEO. **MEXICO.**

Works office: Angangueo, Michoacán, Mexico. Early in 1906 was completing the erection of a smelter, and was developing mines leased of the Michoacán Railway & Mining Co.

ANGEL MINING CO. **ARIZONA.**

Dead. Property has passed to Arizona Gold & Copper Mines Co.

ANGLO-AMERICAN COPPER CO., LTD.

Offices: 21, Ironmonger Lane, London, E. C., Eng. C. E. L. Norris, secretary. Organized Jan. 21, 1905, with capitalization £100, shares £1 par. Debentures, £10,000 authorized, £2,000 issued

ANGLO-AMERICAN COPPER MINING COMPANY OF PARRY SOUND, LTD. **ONTARIO.**

Office: 211 State St., Chicago, Ills. Mine office: Parry Sound, Ontario. Isaac Block, president; Jacob Newman, Jr., secretary and treasurer. Organized 1900, under laws of Ontario, with capitalization $3,000,000, shares $1 par. Lands are on Wilcox Island, near Parry Sound, showing veins carrying copper, silver, gold, cobalt and zinc, rendering the ore exceedingly refractory. Company estimates average ore values at 20% copper and 10 oz. gold per ton, which, of course, is untrue. Has one shaft, 125′ deep. Mine could be operated opencast. Idle for several years.

ANGLO-AMERICAN GOLD & COPPER CO. **MEXICO.**

Dead, but not buried. Lost its lands.

ANGLO-AMERIÇAN MINING & MILLING CO. **MONTANA.**

Mine office: Butte, Silver Bow Co., Montana. Chas. F. Jones, manager. Organized, 1905, by negro residents of New York and Montana. Lands, 5 claims, in the northwestern part of the Butte camp, also sundry claims in Madison county, Montana.

ANGLO-CHILI CONCESSIONS, LTD. **CHILE.**

Offices: Broad Street House, London, E. C., Eng. T. Wilson, secretary. Capitalization £15,000, shares £1 par; issued, £5,250. Is said to have mining concessions in Chile.

ANGLO-CHILIAN EXPLORATION CO., LTD. **CHILE.**

In voluntary liquidation, August, 1905.

ANGLO-ITALIAN COPPER SYNDICATE. **ITALY.**

Said to hold 12,000 acres of copper-bearing land near Genoa, Italy.

ANGLO-ROUMANIAN FINANCE & TRADING CO., LTD. **ROUMANIA.**

Dissolved, August, 1904.

ANGLO-WESTPHALIAN COPPER CO., LTD. **GERMANY.**

Offices: 1, Great Winchester St., London, E. C., Eng. A. W. Johanning, secretary. Organized August 29, 1904, with capitalization £1,000,000, shares £1 par. Property includes the Kampf mine, area 84.7 hectares, also the Gottessegen and Gottesgabe concessions, area 874 hectares, in Rhenish Prussia.

ANGUS COPPER MINING & MILLING CO.

Office: 10 North Eighth St., St. Louis, Mo. Location of property, if any, unknown.

ANI GROUP. **JAPAN.**

Owned by the Furukawa Mining Co.

MINA LAS ANIMAS. **MEXICO.**

Office: care of P. Sandoval y Ca., Nogales, Sonora, Mexico. Mine office: Santa Ana, Sonora, Mex. Ores carry gold, silver, copper and lead. Main shaft, 400′. Has steam power and a 40-ton smelter, employing circa about 25 men, at last accounts.

ANITA CONSOLIDATED COPPER CO. **ARIZONA.**

Reorganized, 1903, as Anita Copper Co.

ANITA COPPER CO. **ARIZONA.**

Office: 224 Milk St., Boston, Mass. Mine office: Williams, Coconino Co., Ariz. C. O. Brightman, president; Henry I. Nesmith, secretary; Paul Whitin Abbott, treasurer: John M. Cameron, superintendent. Organized, August, 1903, under laws of Arizona, with capitalization $5,000,000, shares $5. Beacon Trust Co., Boston, registrar. Lands, 50 claims, area 1,000 acres, surveyed for patents, lying on both sides of the Bright Angel branch of the Santa Fé railway, also a 160-acre millsite and 60 acres miscellaneous lands, giving total holdings of 1,220 acres, all in the Francis mining district. Country rocks are carboniferous limestone, supposedly about 800′ in thickness, showing carrying three known ore bodies, apparently lenses, of which one is undergoing development, this giving oxide and carbonate ores assaying 8% to 15% copper and 3 oz. to 4 oz. silver per ton, with a trace of gold, opened by shafts of 103′, 93′, 40′, 35′ and 580′, and by several hundred feet of short tunnels. Mine has a 10x14″ Fairbanks & Morse gasoline hoist, good for depth of 2,000′, a 12-drill Rand air-compressor and 8 power drills. Smelter, at Williams, 47 miles from mine, with all-rail communication, has a 100-ton water-jacket blast-furnace, with other necessary machinery for a 200-ton smelter.

ANITA COPPER MINES CO., S. A. **MEXICO.**

Mexican corporation of the Douglas Copper Co.

ANITA MINING CO. **MEXICO.**

Office: 11 Wall St., New York. Letter returned unclaimed from former mine office, Bolaños, Jalisco, Mexico. Peter J. Quinn, president; R. W. Elliott, secretary; Thos. R. Warne, manager. Organized April, 1899, under laws of South Dakota, with capitalization $500,000, shares $1 par. Debentures, $35,000 authorized, $10,000 issued, at 6%. Mineral lands, 20 pertenencias, with a 20-acre millsite and 20,000 acres miscellaneous lands, in the Bolaños district. Has 3 shafts, deepest 360′, also 3 tunnels, longest 600′. Property is an antigua, opened circa 1600, again worked 1849-1863, and reopened by present company in 1899. Has steam power, air-compressor, shops, and smelter 4,000′ from the mine, receiving ore by tram, having a 40-ton blast furnace and 20-ton reverberatory furnace, claimed to turn out blister copper carrying 95% copper, 160 oz. silver and 6 oz. gold per ton. Nearest railroad is the Mexican Central, 140 miles distant. Smelter is idle and company experimented with a new-fangled "reduction process," which the inventor firmly expected would turn raw ore into blister copper, without fluxes, in one heat. Idle since circa 1899. Company apparently moribund.

ANNA MINE. **ARIZONA.**

Letter returned unclaimed from former mine office, Providence, Yavapai Co., Ariz. Has a 15 stamp mill.

ANNANDALE MINE, **AUSTRALIA.**

Owned by Blayney Mining & Smelting Co., at last accounts.

ANNIE MINING CO. **WYOMING.**

Office: Laramie, Wyo. Mine office: Jelm, Albany Co, Wyo. Idle. Louis Miller, president and general manager; L. A. Hancock, secretary. Organized 1903, under laws of Wyoming, with capitalization $250,000, shares $1 par. Lands, 2 claims, area 40 acres, in the Jelm district, said to show two 4 contact veins between granite and schist, opened by a 140′ shaft and a 138′ tunnel, showing azurite and bornite, assaying up to 20% copper and $10 gold per ton. Idle since 1904.

ANTIETAM MINE. **ARIZONA.**

Mine office: Metcalf, Graham Co., Ariz. Paul F. Crowley, general manager. Lands, 3 claims, opened by a 146′ shaft, with drifts showing an ore body of 15′ to 35′ width, giving assays of 4% to 10% copper, 7 oz. silver and $2 gold per ton, from chalcocite and chalcopyrite.

COMPAÑIA DE COBRES DE ANTOFAGASTA. **CHILE.**

Office· Blanco No. 144, Valparaiso, Chile. Mine office: Chuquicamata, Antofagasta, Chile. Employs about 100 men. Federico Lesser, chairman; Edourado I. I. Sandiford, vice-chairman; Carlos R. Harrison, secretary; Alejandro Muirhead, general manager. Organized September, 1900, under laws of Chile, with capitalization £65,000, shares £10 par. Lands, 30 claims, area 100 hectareas, also 2 kilometres of river frontage for water power. Property is served by a branch of the Bolivian Railway. Company is developing its more important properties along well-considered and practical lines, and its holdings are situated in what is considered the most valuable portion of the Chuquicamata district.

AO MINE. **NEW CALEDONIA.**

Owned by the Caledonia Copper Co., Ltd.

APACHE COPPER CO. **ARIZONA.**

Office: 72 Trinity Place, New York. Meyer Zulick, president. Capitalization $2,500,000. Lands are in Yuma county, circa 25 miles east of the Colorado river and 100 miles west of Congress Junction, Arizona. Property is developed by shafts and tunnels, showing ore with good gold and silver values. Considerable ore has been mined and is on the dumps. Property is considered valuable, if given adequate transportation facilities, or a near-by smelter.

APACHE DEVELOPMENT CO. **NEW MEXICO.**

Office: care of Martin Pattison, Superior, Wis. Mine office: Hachita, Grant Co., N. M. John E. Penberthy, superintendent. Organized 1905, under laws of Minnesota, with capitalization $1,000,000, shares $10 par. Lands, 23 claims, variously known as the Apache or Copper Crown group, 6 miles south of Hachita, held under bond and lease of $100,000, $10,000 paid. Mine has a 260′ shaft, with about 3,700′ of openings, said to show circa 200,000

tons of medium grade oxide and carbonate ore, with sulphides expected at greater depth.

APACHE & MULTNOMAH MINES. WASHINGTON.

Mine office: Nespelem, Okanogan Co., Wash. F. O. Hudnut, superintendent, at last accounts. Ores carry gold, silver, copper and lead.

APEX COPPER CO. COLORADO.

Office. 304 Colorado Bldg., Colorado Springs, Colo. Mine office: Hayman, Park Co., Colo. Employs 5 men. John K. Vanatta, president; J. O'Driscoll, vice-president and general manager; W. L. Boatright, secretary; Emil Erickson, superintendent. Organized March, 1903, under laws of Colorado, with capitalization $1,000,000, shares $1 par. Lands, 9 claims, and circa 90 acres, in the Lower Tarryall district, showing two nearly vertical contact veins of 3′ average width, between spar and limestone, carrying chalcopyrite and bornite assaying 14% to 30% copper, 7 oz. silver and $1 gold per ton, opened by 5 shafts, 2 deepest being 176′ and 220′, and by tunnels of 250′ aggregate length. Has a 90-h. p. steam plant, 7 drill Leyner air-compressor, 8x10″ hoist and 24x40′ engine house. Company plans deepening No. 2 shaft to 500′, during 1906. Management is well regarded.

APEX GOLD MINES CO. WASHINGTON.

Latest report by management shows no copper values, though such were claimed by preceding owners.

APEX GOLD MINING & MILLING CO. COLORADO.

Mine office: Apex, Gilpin Co., Colo. Chas. E. Barrick, manager. Lands include the Rochester group, on Oregon Hill, opened by a 110′ shaft, showing a vein of 10′ to 12′ width, carrying iron-copper sulphides.

APEX MINING CO. WASHINGTON.

Succeeded, 1903, by the Apex Gold Mines Co.

APOLLO CONSOLIDATED GOLD MINING CO. WASHINGTON.

Office: New Haven, Conn. Mine office: Republic, Ferry Co., Wash. E. J. Delbridge, general manager. Ores carry gold, silver, lead and copper. Has steam power.

APOLLO COPPER MINING & MILLING CO. UTAH.

Letter returned unclaimed from former office and mine, Frisco, Beaver Co., Utah. Geo. A. Gilbert, president; Matilda Olsen, secretary and treasurer. Organized 1902, under laws of Utah, with capitalization $40,000, shares 10c. par.

NESTOR ARAIZA. MEXICO.

Office: Tepezalá, Aguascalientes, Mexico. Is said to own and operate sundry small copper properties in the vicinity of Tepezalá.

ARAKAWA MINE. JAPAN.

Owned by the Mitsu Bishi Gosshi Kwaisha.

ARAMO COPPER MINES, LTD. SPAIN.

Offices: 2, Metal Exchange Bldgs., London, E. C., Eng. Mine office: Pola de Lena, Asturias, Spain. C. W. Aston Key, secretary. Organized July 3, 1897, with capitalization £40,000, shares £1 par. Property is the Aramo copper and cobalt mines. Idle for some years.

many planned and begun. Ores carry gold, silver, lead and copper. Has steam and electric power.

ARGYLE MINING CO., LTD. **ARIZONA.**

Offices: 194, St. Vincent St., Glasgow, Scotland. Letter returned unclaimed from former mine office, Prescott, Yavapai Co., Ariz. A. Mitchell, secretary. Organized December 29, 1900, with capitalization £100,000, shares £1 par; issued, £65,007. Lands, 2 claims, area 40 acres, known as the Examiner and Mineral Hill, near Huron, Yavapai county, Arizona. Idle for several years.

ARIMEX CONSOLIDATED COPPER CO. **ARIZONA & MEXICO.**

Office: 85 Ames Bldg., Boston, Mass. Chas. H. Dickey, president; C. D. Burrage, secretary. Organized under laws of New Jersey, with capitalization $5,000,000, shares $25 par. Property includes the Copper Prince group of 30 claims, in the Silver Bell district, Pima county, Arizona, held through Oxide Copper Co.; seven-eighths of the stock of the Table Mountain Copper Co., which has 27 claims in the Bunker Hill Mining district of Pinal county, Arizona, and nine-tenths of the stock issue of the Angang Copper Co., which holds about 400 pertenencias, known as the Chirangangueo mines, near Zitacuaro, Michoacán, Mexico. Neither of the Arizona properties is of apparent promise, but the Mexican claims might be of some value, if properly developed. The Arimex Consolidated Copper Co. was promoted by Thomas W. Lawson, and, like his other copper mining companies, apparently is merely a stock-jobbing scheme.

ARIZONA & ARKANSAS LEAD, ZINC & COPPER MINING CO. **ARIZONA & ARKANSAS.**

Letters returned unclaimed from former office, 208 Tajo Bldg., Los Angeles, Cal., and from former mine office, Gila Bend, Maricopa Co., Ariz. Described in Vol. V.

ARIZONA BANNER COPPER CO. **ARIZONA.**

Office: 1103 Fullerton Bldg., St. Louis, Mo. Mine office: Globe, Gila, Co., Ariz. Chas. W. Slack, superintendent. Organized 1905, as a reconstruction of the Pinal Copper Co. Lands, 160 acres, known as the Black Copper group, 8 miles northwest of Globe, developed by 10 shafts and tunnels, and claimed to have 20,000 tons of 10% to 15% ore in sight. Idle since 1901.

ARIZONA BELLE MINING CO. **ARIZONA.**

Organized Feb. 20, 1906, at Tucson, Arizona, by 8 shareholders of the Virginia Belle Gold & Copper Mining Co., apparently to take the lands formerly held by latter company.

ARIZONA BLUE BELL COPPER CO. **ARIZONA.**

Presumably dead, as Blue Bell mine has passed to Arizona Exploration Co.

ARIZONA CENTRAL COPPER CO. **ARIZONA.**

Letter returned unclaimed from former office, Prescott, Ariz. Mine office: Williams, Coconino Co., Ariz. J. F. Wilson, president; J. M. Elder, secretary.

ARIZONA-COLORADO COPPER BELT & GOLD MINING & MILLING CO. **ARIZONA.**

Office: 305 State Life Bldg, Indianapolis, Ind. Mine office: Globe, Gila

Co., Ariz. Hon. Robert M. Foree, president and general manager; Chas. Trotter, secretary; C. Fenger, treasurer; J. Bandhauer, superintendent. ganized September, 1901, under laws of Arizona, with capitalization $2,500,0 shares $1 par. Lands, 18 claims, area 370 acres, adjoining the Old Domin the southwest, showing veins ranging from 3′ to 100′ in width, carrying iferous and argentiferous oxide and carbonate ores, assaying 8% to copper, 20% to 50% lead, 1 oz. to 200 oz. silver and $3 to $30 gold per Has 7 pits and shafts, main shaft 400′, and tunnels of 10′ to 200′ Is sinking three shafts, and it is planned to crosscut at 500′ depth.

ARIZONA COMMERCIAL CO. AAIZO

Succeeded, 1904, by Arizona Commercial Copper Co.

ARIZONA COMMERCIAL COPPER CO. ARIZO

Office: 11 Pine St., New York. Mine office: Globe, Gila Co., A N. L. Amster, president; F. B. Close, consulting engineer; W. S. Sultan, sup intendent; N. L. Amster, Chas. H. Paine, R. T. McKeever, Robert W. E mons, Alex. B. Clough and Sigourney W. Fay, directors; American Loan Trust Co., Boston, transfer agent. Organized, January, 1905, under la of Maine, with capitalization $2,500,000, shares $25 par. Of the stock is $1,000,000 was given the Arizona Commercial Co., and $1,000,000 to the M mora company, for their respective properties, retaining $500,000 in the treas for working capital. In December, 1905, company had $62,191 cash on ha

Lands lie just north of the Old Dominion and adjoin the United Glo principal properties being the Copper Hill and Black Hawk mines. The Co per Hill has a 600′ two-compartment shaft, to be deepened to 800′, equipp with a new hoist and air-compressor. This shows sulphide ores on the thi fourth, and sixth levels, the sixth level, at the bottom, showing a vein of 9′ to 1 width, ranging 5% to 8% copper, with considerable covellite 10% or better tenor. The Copper Hill mine has reserves of sulphide ore estimated 100,000 tons, also several hundred thousand tons of silicious carbonates, or near surface, which are mined at a cost of about 50 cents per ton, and co be won much cheaper with a steam shovel. The Copper Hill is connect underground, for ventilation and safety, with the Gray mine of the O Dominion.

The Black Hawk mine has two shafts, deepest 265′. The surface capp is a low-grade iron ore. At surface a 45′ vein of silicious ore averages abo 4% copper, with excess of iron. There also is a hematite vein of 3′ to 1 width, carrying 4% to 7.5% copper, with small silver values. The mine h upwards of a mile of underground openings.

Production was begun July 26, 1905, with shipments of 50 tons daily to th Old Dominion smelter, and Sept. 27, 1905, shipments were begun to the Copp Queen smelter, at Douglas. At close of 1905 mine was shipping about 50 to daily to each smelter, and employed upwards of 100 men. It was planned t increase production to about 200 tons daily by spring. The ore smelted in 1 gave net returns of about $5 per ton, and company was netting about $10,0 monthly at close of the year.

Railroad connection was secured in 1905. The Arizona Commercial h

considerable promise, and the new management, which is composed of able and experienced copper men, is sufficiently strong financially to assure giving the mine a fair chance.

ARIZONA CONSOLIDATED COPPER MINES, LTD. **ARIZONA.**

Offices: 80, Coleman St., London, E. C., Eng. W. W. Macalister, secretary. Organized June 17, 1899, with capitalization £150,000, shares £1 par. Lands, sundry claims in the Copper Mountain district of Graham county, Arizona. Apparently no work was done thereon by present company.

ARIZONA CONSOLIDATED MINING CO. **ARIZONA.**

Office: 1420 Chestnut St., Philadelphia, Pa. Mine office: Benson, Cochise Co., Ariz. Chas. M. Dodson, president; Garrett B. Lindermann, treasurer; Samuel D. Luckenbach, secretary; Samuel J. Entrichken, general manager; Hale McCormick, superintendent; Kempton & McCoy, consulting engineers. Organized July , 1904, under laws of Delaware, with capitalization $1,000,000, shares $1 par, in $300,000 preferred and $700,000 common stock.

Lands include the Russell mines, in the Dragoon Mountains, formerly owned by the Russell United Copper Co. Property is in two groups, known as the New Republic and Mammoth. The New Republic has a 225′ two-compartment shaft, sunk at an angle of 45° with the horizon, showing a 2′ vein of high-grade oxide and sulphide ore, running 7% to 12% copper, also open-cuts showing 15% ore with fair silver values. The Mammoth group has a 270′ shaft, from which upwards of 1,000 tons of ore has been shipped, giving returns of 10% to 26% copper. Power is furnished by a 150-h. p. Witte gasoline engine. At close of 1905 mine was making small shipments to smelters, while pushing development. Property seems of considerable promise, and apparently has a good management.

ARIZONA COPPER CO., LTD **ARIZONA.**

Offices: 29, St. Andrew Sq., Edinburg, Scotland. Mine office: Clifton, Graham Co., Ariz. Employs circa 2,000 men. John Gill, chairman; Jas. Colquohoun, general superintendent; Alex. Veitch, general manager; Wm. Exley Miller, secretary; Geo. Fraser, smelter superintendent; Archibald Morrison, mill superintendent; C. D. Clark, mechanical engineer; A. T. Thompson, mine clerk. Organized August 5, 1884, with capitalization £755,000, of which £703,984 is issued, in 160,000 "A" preference shares of 5s. par; £316,530 fully paid preference shares; £316,530 fully paid preferred ordinary shares; and £63,444 fully paid deferred shares. Profits are divided as follows: 10% cumulative dividends on "A" preference shares; cumulative 7% dividends on preference shares; 10% non-cumulative dividends on preferred ordinary shares; 10% non-cumulative dividends on deferred ordinary shares; balance, if any, to be divided pro rata between preferred ordinary and deferred ordinary shares. Debentures, £175,490 outstanding, at 5%. Fiscal year ends Sept. 30th. Dividends for fiscal year ending September 30, 1905, were £284,980, carrying forward a balance of £11,874. In addition to paying large dividends the company has expended about £600,000 in reconstruction of plant, railways, etc., since 1901. About 20% of the stock issued is held in the United States.

Lands, circa 4,000 acres, including eight producing mines, at Morenci.

Metcalf, Longfellow, Garfield and Coronado, in Graham county, Arizona. The ores average about 3.25% copper and production is about 10% smelting ore and 90% concentrating ore. The mines are developed to a depth of about 500′ only, and are opened mainly by tunnels, giving cheap extraction. Notwithstanding the comparative shallowness of the properties, a tremendous amount of ore is developed, ore reserves being estimated, March, 1905, at 10,370,600 tons, "practically in sight."

The Humboldt mine, which is the largest producer, shows an enormous body of low-grade disseminated chalcocite. Extraction from this property is partly open-cast, but mainly through tunnels equipped with electric lights and electric traction. The haulage system uses the overhead trolley, power being furnished by a 146-h. p. Crossley gas engine, driving a 100-h. p. generator that furnishes a 225-volt current. Electric locomotives of 10-h. p. haul 40-ton loads the line having a single track laid with 35-lb. rails, running 600′ directly through the mountain, with a loop reaching all workings of the Humboldt mine, tunnel running through International Hill direct to the new concentrator.

The Longfellow mine is the oldest important copper producer of Arizona, dating from circa 1877. A new tunnel, driven in from Chase creek, will do away with the hoisting plant and permit cheaper extraction, while opening the mine to much greater depth than heretofore. The Longfellow Extension mine is developing well.

The Metcalf group, 7 miles from Clifton, is worked open-cast and is an extensive producer of low-grade oxidized ores, which are concentrated with the sulphide ores from the Humboldt and Yavapai groups. The Coronado group, 9 miles from Clifton, has 3 new shafts, deepest 400′, sunk almost entirely in ore, and the mine is showing considerable high-grade ore.

The Clay mine, which has been only a small producer in the past, is being developed to highly important dimensions, and shows a very large tonnage of low and medium grade ores.

Ore is taken from the different mines by 6 gravity tram-lines, to storage bins on the Coronado railroad, thence to the reduction plant, at Clifton, which was remodeled,1902, and further enlarged in 1904 and 1905, and now includes six concentrators, a smelter, acid plant and leaching plant. The concentrators have a combined daily capacity of 1,700 tons, and are operated by gas and electric power. The concentrators put 6.6 tons of crude ore into one ton of concentrates, and Chase creek has been dammed, to stop the tailings going into the Frisco river, and thence into the Gila river, which formerly caused considerable damage to farmers and ranchers, and was an annoyance to all concerned. Concentrator and smelter are connected by a gravity tramway. The new 700-ton concentrator, at the Longfellow mine, was progressing rapidly at the beginning of 1906, and should be in operation during the latter half of the year. This will give a daily milling capacity of 2,400 tons or just double the capacity of 1904. A new concentrator for the Coronado mine is planned, when the new electric power installation is completed. Two Hancock jigs were installed during 1905, handling 600 tons daily and replacing 35 Frue Vanners and 2

Wilfley tables. The Hancock jigs require little water and are highly economical of floor space, these two machines replacing 45 separate machines formerly in use. Allis-Chalmers high-speed rolls have been installed for crushing, and Huntington mills for regrinding.

A complete electric power plant is planned. This will generate energy and transmit same electrically to the mines and works, from a dam about 50 miles distant.

The smelter has a steel frame, slate roof, and floor of iron plates laid in cement, being well designed and thoroughly modern. There are six 300-ton water-jacket furnaces, each 39x240′ at the tuyeres, treating about 250 tons each, daily, with blast supplied by Nos. 7, 9 and 10 Connersville blowers, operated by a 270-h. p. engine. Gases from the furnace pass through a 480′ tunnel and a 300′ shaft, discharging 600 above the level of the town. Slag settlers of a new type are 7x14′, and 3′ deep, with a 6″ fire-brick lining. Matte of 50% to 55% is charged into the converters by a 10-ton ladle, operated by a 30-ton electric crane. The conversion plant has 3 stands, with six 7-ton shells, having a daily capacity of 50 tons of 99.5% blister copper. Disintegration of slag by running water was tried, but has been discontinued, and molten slag again is handled in ladel cars, by a steam locomotive. A new briquetting plant, built 1905, has 25 tons capacity per 10-hour shift. Pitch is used for a binder, under 2,000 lbs. pressure per square inch. Plant is entirely automatic, fines going in at one end and briquettes being loaded upon cars at the other. The reduction plant went into commission in 1901, and is well designed and thoroughly modern throughout.

The works have an acid plant, making about 3,500 tons of sulphuric acid yearly, from the fumes of the roasters, the entire product being used in the leaching plant, which treats an average of about 250 tons of low-grade oxidized ores daily. In connection with the lixiviation works there is a 125-ton blue-stone plant, making about 3,000,000 lbs. of copper yearly. The Arizona has developed the most successful leaching plant in the United States, and its management is entitled to great credit therefor.

The mines and works use about 3,000 h. p., supplied almost equally from gas, steam and distillate engines. The company operates the Coronado railway, and fitted with 30-ton ore cars of standard gauge, for 4 miles from Clifton to Longfellow, and of 36″ gauge 2.5 miles from Longfellow to Metcalf, also the Arizona & New Mexico railway, a standard-gauge line running 107 miles from Clifton to Hachita, N. M., where connections are secured with the El Paso & Southwestern. Profits of these lines were £69,173 in 1903.

Miscellaneous enterprises of the company include a well-equipped foundry, machine shop, sawmill, planing mill and 20-ton ice plant, all of brick. A good library and reading room are maintained for employes. Production was 32,197,760 lbs. fine copper in 1904, and about 26,836,000 in 1905 and should reach 35,000,000 lbs. in 1906. The property is one of great magnitude, and production can be largely increased by enlarging the already extensive plant. The company's management is excellent, both as to finances and the physical handling of the mines, mills and smelters.

ARIZONA COPPER & GOLD MINING CO. ARIZO

Letter returned unclaimed from former office, Phoenix, Ariz. L sundry claims in the Harcuvar Mountains, northeastern Yuma county, veloped by a 55′ tunnel, showing a 5′ vein of auriferous copper ore, a 220′ shaft, bottomed in a vein, apparently about 20 wide, carrying chite and chalcopyrite. Is said to have about 1,000 tons of shipping o the dump.

ARIZONA COPPER HILL MINING CO. ARIZ

Office: Jackson Bldg., Denver, Colo. Mine office: Oracle, Pinal Ariz. Edwin Scott, president; J. H. Edwards, secretary; Frank J. B superintendent. Organized 1900, under laws of Arizona, with capitaliza $1,000,000, shares $1 par. Lands, 4 patented claims, area 65 acres, al 5-acre millsite and 160 acres miscellaneous lands, in the Cañada del Oro trict, said to show a contact vein 20′ to 70′ width and 4,800′ length, ope by shafts of 281′ and 350′, and by a 350′ tunnel, with 2,000′ of undergro openings. Is claimed to have 500,000 tons of low-grade silicate and c bonate ores developed. Has steam and gasoline power and 100-ton cyani plant. Hubert Reynolds and other shareholders are suing officers, alleg in suit that directors voted to secure a loan of $25,000 by mortgage, tak only 75% of face of loan in cash, and turning 35% into treasury, balance b ing divided as bonuses among officers.

ARIZONA COPPER MINING CO. ARIZON

Office: care of Geo. H. Parker, secretary and treasurer, Los Angeles, Cal. Mine office:Tucson, Pima Co., Ariz. E. C. Griffith, president; B. C Brechta, superintendent. Lands, 20 claims, in the Tucson Mountains, nea Tucson, slightly developed by a 400′ tunnel, said to show an 8′ vein carryin ore of good grade.

ARIZONA COPPER MOUNTAIN MINING CO. ARIZONA

Office: care of B. T. MacMasters, secretary and treasurer, First Nation Bank Bldg., Chicago, Ills. Organized Jan. 25, 1901, under laws of Utah, with capitalization $1,000,000, shares $1 par. Lands 6 claims, area 120 acres in process of patenting, 25 miles from a railroad, in the Copper Mountain di trict of Mohave county, Arizona, developed by 4 shafts, deepest 200′, and a tunnel of 183′, with a total circa 1,500′ of underground openings, showing 5 veins of 3″ to 30′ width, carrying oxide and carbonate ores, with a litt chalcocite, giving good assays in copper, with gold values of $1.20 to $8.0 per ton. Employs 3 men and plans increasing force.

ARIZONA COPPER MOUNTAIN MINING CO. ARIZONA

Title changed, 1904, to Copper Butte Mines.

ARIZONA COPPER PLACER MINING & MILLING CO. ARIZONA

Said to have lands near Quartzite, Yuma county, Arizona.

ARIZONA COPPER SYNDICATE. ARIZONA

Letter returned unclaimed from former office, 32 Broadway, New Yor Organized under laws of West Virginia. Lands were forfeited, and aft wards bought back by leading shareholders, and deeded back to compa subject to a $7,000 mortgage, covering back taxes and cash advanced.

effort was made, circa 1904, to reorganize under title of Clifton Copper Mines, Ltd.

ARIZONA COPPER SYNDICATE, LTD. **ARIZONA.**

An English corporation. Moribund.

ARIZONA DIAMOND DRILL MINING DEVELOPMENT CO. **ARIZONA.**

Office: care of Owen McAleer, Los Angeles, Cal. Officers of company are largely holders of political offices. Company's advertising is exceedingly vague and unbusinesslike.

ARIZONA & EASTERN CONSOLIDATED MINING CO. **ARIZONA.**

Office: care of Maj. E. L. Delestry, general manager, St. Paul, Minn. Mine office: Globe, Gila Co., Ariz. Organized Dec., 1905, under laws of Arizona, with capitalization $1,500,000, shares $5 par. Lands, 6 claims, known as the Patterson group, in the Mineral Creek district, developed by a 400′ tunnel. Claims are regarded favorably, but company is not.

ARIZONA & EASTERN MINES & POWER CO.

Office: 6–135 Grand Ave., Milwaukee, Wis. J. O. Buckley, president and treasurer; Henry R. Buckley, vice-president; Thos. T. Somers, secretary; Donald Ferguson, general manager and consulting engineer. Capitalization $7,500,000, shares $100 par. Company advertises that it wishes to purchase mining properties in Arizona or Sonora.

ARIZONA, EASTERN & MONTANA SMELTING & ORE PURCHASING CO. **MONTANA.**

A swindle, promoted by the notorious Dr. R. C. Flower.

ARIZONA EXPLORATION CO. **ARIZONA.**

Mine office: Mayer, Yavapai Co., Ariz. Ernest A. Haggott, superintendent. Company is composed mainly of shareholders of the Arizona Smelting Co., which is building a new smelter at Humboldt, and also is closely connected with the De Soto Mining Co. Lands are the Blue Bell group, formerly owned by the Arizona-Blue Bell Copper Co. The Blue Bell mine is being connected with the Prescott & Eastern Railway by an aerial tram. The group of 3 claims has 3 fissure veins in Algonkian slates, with quartzite footwall and grano-diorite hanging, developed by 6 shafts, deepest 300′, and by tunnels of 70′ and 75′, showing cuprite, malachite and chalcopyrite, all slightly argentiferous and auriferous, with a large ore body opened on the 300′ level. Machinery is to be actuated by electric power, carried by a 10-mile transmission line.

ARIZONA GIANT COPPER CO. **ARIZONA.**

Office: 229 Byrne Bldg., Los Angeles, Cal. Mine office: Ehrenburg, Yuma Co., Ariz. R. M. Furlong, president; H. Franklyn Hiller, secretary and treasurer. Capitalization $3,000,000, shares $1 par. Lands, 320 acres. Old management, which sold considerable stock, at fancy prices, was ousted, September, 1903. Apparently moribund.

ARIZONA GOLD & COPPER CO. **ARIZONA.**

Office: 30 Broad St., New York. Mine office: Patagonia, Santa Cruz Co., Ariz. Floyd B. Wilson, president; Frederick K. Jones, secretary; Col. Geo. W. Crowe, general manager; Harry L. Vaughn, superintendent. Organ-

ized February, 1900, under laws of Arizona, with capitalization $1,000,
shares $1 par. Debentures, $32,500 first-mortgage 6% bonds, dated
1, 1902. Lands, 7 claims, area 140 acres, in the Tyndall district of the S
Rita mountains, including the Gaelic, Trenton and Salero mines, open
7 shafts and a tunnel, latter showing a 4′ vein said to average 3% copper,
to 20% lead and 10 oz. silver per ton. Has a 50-ton concentrator, built
and an 80-ton smelter, at Patagonia. Idle.

ARIZONA GOLD & COPPER MINES CO. ARIZ

Letter returned unclaimed from former office, 19 Park Row, New Y
Mine office: Wickenburg, Maricopa Co., Ariz. Property was the Angel
showing gold and copper ores.

ARIZONA GOLD & COPPER REDUCTION CO. ARIZ

A swindle, promoted by the notorious Theodore Stegner.

ARIZONA GOLD MINING CO. ARIZ

Letter returned unclaimed from former office, Chamber of Comm
Bldg., Portland, Ore. Mine office: Wickenburg, Maricopa Co., Ariz. O.
Perry, president and general manager; W. T. Perry, secretary. Ores co
gold and copper.

ARIZONA GOLD MINING & MILLING CO. ARIZ

Dead. Formerly operated the Swallow mine, at Briggs, Yavapai co
Arizona.

ARIZONA-HANCOCK CONSOLIDATED MINING CO. ARIZ

Office: Hancock, Mich. Mine office: Florence, Pinal Co., Ariz. J.
D. Cuddihy, president; Alfred C. Sieboth, vice-president and supe
tendent; Henry L. Baer, secretary and treasurer. Organized Mar. 26, 19
under laws of Arizona, as successor to the Arizona & Hancock Mining C
with capitalization $500,000, shares $10 par. Annual meeting, first Tue
after first Monday in March. Lands, 4 claims, company having thrown
the 15 claims formerly held in the Globe district. The Pinal county l
show a vein traversing two claims parallel to the vein of the Lake Supe
& Arizona, with diabase footwall and limestone hanging, opened by a sh
tunnel and a winze of 55′, with drifts on two levels, showing lead above
copper below. Idle.

ARIZONA & HANCOCK MINING CO. ARIZ

Succeeded, March 26, 1903, by Arizona-Hancock Consolidated Mining C

ARIZONA-MEXICAN COPPER CO. MEXI

Office: Phœnix, Arizona. Mine office: Caborca, Sonora, Mexico. J.
Hubinger, president; W. E. Defty, vice-president and consulting engine
W. C. Foster, treasurer; C. T. Vincent, superintendent; J. C. Flores, m
foreman. Organized February 14, 1902, under laws of Arizona, with cap
talization $3,000,000, shares $10 par; issued, $2,220,000. Lands, 79 pert
nencias, known as La Gran Proveedora de Cobre, in the Altar district,
miles from the Sonora Railway. Country rock is granite, ores carrying
iron and spar gangue, forming an ideal self-fluxing ore. Vein is 228′ wi
giving average assays of 6.7% copper, 12 oz. silver and $2 gold per ton, and
is opened by shafts of 102′ and 200′, and by tunnels of 209′ and 228′. A winz

C. S. Mesenry, secretary; Le Roy Scholl, general superintendent. Organ... February 1, 1906, under laws of Arizona, with capitalization $3,000... shares $10 par. Bonds, $300,000, at 5%. Lands, 14 claims, area circ... acres, also a 15-acre millsite and 100 acres timber lands, on Pinto Creek, ... ing a contact vein between schist and granite, averaging 14′ in width, ... traced 785′, giving average assays of 9% copper and $4 gold per ton, ... chrysocolla, chalcopyrite and occasional bornite. Development is by sh... of 50′ and 85′ and tunnels of 195′, 250′, and 300′, with a total of 2,000... openings. Management estimates 18,840,000 tons of concentrating ore ... 3,297,000 tons of smelting ore in sight, with 1,000,000 tons blocked out ... stoping, which figures are sadly in need of revision by a truly mod... man.

ARIZONA-PACIFIC COPPER CO. ARIZO...

Office: 705 State Life Bldg., Indianapolis, Ind. Mine office: Flore... Pinal Co., Ariz. F. P. Jeffries, president; John W. Sharpe, vice-presid... and general manager; Henry Severin, treasurer; Murat W. Hopkins, sec... tary; E. R. Stafford, superintendent. Organized March 30, 1903, under la... of Arizona, with capitalization $5,000,000 shares $1 par. Lands, 16 clai... area 330 acres, also an 80-acre smelter site and 160 acres of possible oil land... lying at Wesley, about 7 miles south of Kelvin, connected by 4-mile wag... road with the Phoenix & Eastern railway, which has a switch for the compa... Property shows sundry minor veins, assaying 3% to 20% copper and $5 ... $20 gold per ton. A quartz-porphyry dyke, 1,200′ long and about 500′ ... extreme width, with axes east and west, is shattered in every direction, a... cemented by veins carrying cuprite, melaconite and chalcocite, giving est... mated average values of 3% copper, 1 oz. silver and $2 gold per ton. Ha... shafts of 80′ and 350′, 600′ apart, also tunnels of 260′ and 342′, at sam... distance. Has 2 gasoline hoists, air-compressor, power drills, and necessary... mine buildings. Officers of company are men of good standing and th... property is regarded as promising, owing to great size of the ore body, thou... the ore is low in tenor, but well adapted to close and economical concen... tration. Development is continuing on a modest scale.

ARIZONA SMELTING CO. ARIZONA...

Office: 71 Broadway, New York. Mine office: Middelton, Yavap... Co., Ariz. Works office: Humboldt, Yavapai Co., Ariz. Employs about 8... men. John L. Elliott, president; Chas. E. Finney, vice-president and ge... eral manager; Benj. Prince, secretary and treasurer; preceding officers, Frank... M. Murphy and Arthur Braun, directors; R. T. Mason, mine superintendent; ... E. H. Hamilton, smelter superintendent; Cyrus Robinson, consulting engi... neer; Pope Yeatman, mining engineer; L. Douglass Anderson, mechanical ... engineer; E. W. Brooks, purchasing agent and chemist; Jas. D. Grant, auditor ... and cashier. Organized February, 1905, under laws of New Jersey, with ... capitalization $150,000, shares $100 par. Bonds, $180,000 issued, at 5%. ... Annual meeting, first Monday in December.

All buildings of the concentrating and smelting plant are of steel frame, ... with steel roofs, brick walls and cement floors. The concentrator, of 400

tons daily capacity, is 160x200′, equipped with 2 Blake crushers, 2 centrifugal crushers, 4 trains of rolls, 2 Hancock jigs, 16 Overstrom tables, 16 vanners and 8 sizers.

The smelter is of 1,100 tons daily capacity, and is so constructed that its capacity can be increased easily to 1,500 tons, whenever desired. Smelter has both lead and copper stacks, and is equipped with three 100′ Edwards mechanical roasters, a 200-ton blast furnace and two 100′ reverberatory furnaces of the Anaconda type, rated at 450 tons daily capacity each. The converter has two stands. Connected with the smelter is a small but complete sampling mill, operated automatically throughout. The power plant has four 375-h. p. Stirling water-tube boilers, burning waste gases. The entire plant is operated by electricity, having two 450-h. p. cross-compound condensing generators. California crude oil is used for fuel in the reverberatory furnaces. The plant includes electrically driven turbine pumps.

Miscellaneous buildings include machine shop and laboratory. The reduction plant has a complete water system and electric light plant, with about 4 miles of standard-gauge railroad, laid with 65-lb. rails.

Smelter was blown in early in 1906, and is planned to do a custom business exclusively The company is receiving and paying cash for custom ores. Cost of the plant presumably is greater than total capitalization and bond issue of the company, which is something of a novelty. The plant is thoroughly modern throughout, and the enterprise appears legitimate and businesslike in every detail.

ARIZONA SYNDICATE. **ARIZONA.**

Letters returned unclaimed from former office, O. T. Johnson Bldg., Los Angeles, Cal., and from former mine and smelter office, Kelvin, Pinal Co., Ariz. P. B. McCabe, president; O. B. Bachman, secretary and treasurer. Property included the Bobtail and Apache groups of mines, near Kelvin, and a small smelter at Kelvin.

ARIZONA UNION CONSOLIDATED GOLD & COPPER MINES CO. **ARIZONA.**

Office: care of Hall & Co., Cincinnatus Bldg., Cincinnati, Ohio. J. B. Hall, president; Jos. H. Mageer, secretary. Lands, supposed to be 54 claims, circa 150 miles from Fairfield, Utah, the nearest railroad station. Company's literature deals liberally in glittering generalities. Property idle at last accounts.

ARIZONA UNITED COPPER CO. **ARIZONA.**

Office: 35 Wall St., New York. Edmund D. Willetts, president, at last accounts. Moribund.

ARIZONA UNITED COPPER MINING CO. **ARIZONA.**

Letter returned unclaimed from former office, St. Louis, Mo.

ARIZONA & WEST LAKE COPPER CO. **ARIZONA.**

Letter returned unclaimed from former office, Bisbee, Arizona. John M. Stanaway, president. Organized 1903, under laws of Arizona, with capitalization $1,000,000. Lands, 18 claims, 3 miles northwest of Packard, Cochise county, Arizona, opened by a 65′ shaft.

ARIZPE DEVELOPMENT CO. **MEXICO.**

Office: care of Frank Graf, Bisbee, Ariz. Mine office: La Cananea, Sonora, Mex. J. P. Hallihan, president; G. D. Cash, secretary. Lands, 15 miles southeast of La Cananea, include the Alacran mine, carrying values mainly in silver. Late in 1905 shipped some high grade ore to El Paso, this running up to 175 oz. silver and $2 gold per ton.

ARIZPE GOLD & COPPER CO. **MEXICO.**

Dead. Had lands in the Arizpe district of Sonora, Mexico.

ARIZPE MINING & DEVELOPMENT CO. **MEXICO.**

Office: Chicago, Ills.

ARLINGTON-BURNS COPPER-GOLD CO., LTD. **BRITISH COLUMBIA.**

Letter returned unclaimed from former offices in Chicago and Seattle. Mine office: Greenwood, Yale district, B. C. M. M. Lytle, president; Chas. A. Spirk, secretary and treasurer; E. H. Harrison, auditor. Lands, 3 claims, area 86 acres, known as the Arlington, Burns and Blue Bell, 1½ miles from Greenwood, having 627′ of development, including opencuts and shafts, with a little stoping. Company apparently moribund

ARLINGTON COPPER CO. **NEW JERSEY.**

Dead. Lands, at Arlington, N. J., sold Sept. 30, 1903, for debt.

ARLINGTON MINE. **WASHINGTON.**

Letter returned unclaimed from former mine office, Conconully, Okanogan Co., Wash. Ores carry gold, silver and copper.

ARMINIUS CHEMICAL CO. **VIRGINIA.**

Office: 56 Wall St., New York. Mine office: Mineral City, Louisa Co., Va. Rowland F. Hill, president; W. Maw, secretary; Alvin P. Maw, general manager. Mines cupriferous pyrites. Has steam power and a concentrator.

ARMSTRONG MINE. **CALIFORNIA.**

Office: care of W. Roy, Merced, Cal. A prospect, in Indian Gulch, Mariposa county, California.

ARNOLD MINE. **MONTANA.**

Office: care of Dr. G. E. Blackburn, 36 New Owsley Bldg., Butte, Montana. The Arnold and Snow Bird claims are prospects, near Elliston, Powell county, Montana, opened to a depth of 70′, to which depth the Arnold has produced $75,000 worth of copper ore, ranging 10% to 34% in tenor.

ARNOLD MINING CO. **MICHIGAN.**

Office: 61–50 State St., Boston, Mass. Mine office: Copper Falls, Keweenaw Co., Mich. C. Howard Weston, president; John Brooks, secretary and treasurer; Wesley Clark, superintendent. Annual meeting, second Tuesday in May. Organized 1864, under laws of Michigan, with capitalization $2,500,000, shares $25 par; issued, $1,550,000. Lands, 3,323 acres, in T. 58 N., R. 31 W., in two tracts, including the Old Copper Falls mine and the Arnold mine proper, with frontage of about 3 miles on Lake Superior. The Copper Falls mine, worked, circa 1850 until August 1893, made 12,843 tons, 429 lbs. fine copper, mainly from the Owl Creek fissure, and paid dividends of $100,000. The Arnold mine proper, developed on the Arnold ashbed, was opened 1863, reopened 1897, closed 1901, rock stamped averaging

under 0.8% copper. Has a stamp-mill and 2½ mile narrow-gauge railroad, known as Arnold & Eagle Harbor, rolling stock of which has been sold. No. 1 shaft of the Arnold is about 1,000′ deep, sunk at an angle of 26° with the horizon.

ARPS CLAIMS. **CALIFORNIA.**

A group of 15 claims, in Town 34 North, Range 3 West, Shasta county, California, opened by 4 tunnels, of 1,600′ aggregate length, giving a fair showing of sulphide ore. Letters addressed to putative owners returned unclaimed from Redding, California.

ARRINO PROPRIETARY COPPER MINING CO. **WEST AUSTRALIA.**

Office. 17, Queen St., Melbourne, Australia. David Blair, manager. Property, in Western Australia, shows sandstone beds of Permian age, ore occurring as bunches and thin veins following the joints and fissures of the sandstone. Ores are mainly oxides and carbonates, with a little sulphide ore exposed recently. Sandstone formation, occupying a basin with gneiss walls, is about 300′ wide by one mile long. Bulk parcels of ores shipped have given returns of 3.75% to 25% copper. Property has rail connections, but the process best adapted to treating ores of such unusual nature and occurrence had not been decided upon, at last accounts.

ARTOLA HERMANOS. **CHILE.**

Mine office: Cobija, Tocapilla, Antofagasta, Chile. Operate the Gatico mine, opened 1891. Product, shipped as matte, is equivalent to an average annual output of 1,000 to 1,200 metric tons of fine copper.

ERZBERGWERKE ASBECK BRÜGGEN–UND BRÜGER-ROBERT. **GERMANY.**

Mine office: Rönsahl, Westfalen, Germany. Idle.

ASCOT MINE. **QUEBEC.**

Mine office: Capelton, Sherbrooke Co., Quebec. Presumably idle.

ASHBED MINING CO. **MICHIGAN.**

Office: 64–50 State St. Boston, Mass. Mine office: Copper Falls, Keweenaw Co., Mich. C. Howard Weston, president; John Brooks, secretary and treasurer; Wesley Clark, superintendent; preceding officers, T. P. Farmer and W. C. Fiske, directors. Organized, 1880, under laws of Michigan, with capitalization $1,000,000, shares $25 par. Annual meeting, second Tuesday in March. Lands, 1,143 acres, in vicinity of Copper Falls, adjoining the Arnold mine. Property was known originally as the Petherick. Work was resumed on a small scale June, 1905, and in March, 1906, was in progress on two levels, point of attack being a cross-fissure vein. Fully described in Vol. II.

ASHEBORO COPPER MINING CO. **NORTH CAROLINA.**

Mine office: Asheboro, Randolph Co., N. C. H. D. Landers, president; D. M. Holliday, vice president; W. C. Hammond, treasurer; M. W. Parrish, secretary; W. L. Thurber, manager. Organized under laws of North Dakota, with capitalization $100,000, shares $1 par. Lands 93 acres, on which a little mining was done in the Nineteenth Century. Has shipped a carload of ore giving returns of $16.85 per ton, with copper returns of 8.6% and small

gold values. Also has an option on 400 acres of gold-bearing lands.

ASHIO MINES. **JAPAN.**

Owned by the Furukawa Mining Co.

ASHLAND MINING CO. **COLORADO.**

Mine office: Ohio, Gunnison Co., Colo. Carroll M. Carter, superintendent, at last accounts. Property is the Carter group, carrying gold, silver, lead, copper and zinc ores. Has steam power.

COMPAÑIA MINERA DE ASIENTOS. **MEXICO.**

Mine office: Asientos, Aguascalientes, Mex. Harry Rab, superintendent. Lands include the Nopensada mine, producing copper and silver. Main shaft, 200'. Has steam and electric power.

WALTER ASKEW. **MEXICO.**

Office and mine: Guachinago, Jalisco, Mexico. Property is known as the Ocote, showing a large vein giving good assay values in copper, silver and gold.

SOCIETE CIVILE DES MINES DE CUIVRE D'ASPEICH. **FRANCE.**

Offices: 3, Rue de Milan, Paris, France. G. Caton, manager, at last accounts. Lands are in the Basses Pyrenees, France. Idle.

ASTOR MINING CO. **COLORADO.**

Mine office: Eureka, San Juan Co., Colo. E. C. Condit, superintendent. Property includes the Surprise, Mogul and other claims, carrying ores of gold, silver, lead and copper. Has steam, water and electric power.

SOCIEDAD INDUSTRIAL ASTURIANA. **SPAIN.**

Office: Oviedo, Spain. Mine office: Torres, Teruel, Spain. Lands are a group of slightly developed claims, near Torres.

SOCIEDAD INDUSTRIAL DE ATACAMA. **CHILE.**

Office and works: Tierra Amarilla, Copiapó, Atacama, Chile. Mines include the Lautaro, at Almolanos, in the San Antonio district of Copiapó, and other properties, and the company also has an idle smelter at Caldera. In 1903 the smelter at Tierra Amarilla treated 17,526 metric tons of ore, giving average returns of 11% copper, with considerable gold values, product being shipped to Wales as a rich auriferous copper matte.

ATACAMA MINERAL CO., LTD. **CHILE.**

Voluntarily liquidated, July, 1902.

ATE MINE. **JAPAN.**

Mine office Komatsu, Kaga, Japan. Works two main veins, in liparite and brecciated tufa, one being a fissure and one a contact vein. These veins cross, intersection giving the richest ore, and at a little distance from the point of intersection the veins thin out and become ofpo or quality. Ore is chalcopyrite, with iron pyrites, showing bornite and tenorite, averaging about 10% copper in the upper portions. Production, 1900, was 231,484 lbs. fine copper.

ATHELSTAN GOLD MINING CO., LTD. **BRITISH COLUMBIA.**

Absorbed, 1904, by Montreal & Boston Cons. M. & S. Co.

ATHELSTON & JACKPOT MINING CO. **BRITISH COLUMBIA.**

Absorbed, 1904, by Montreal & Boston Cons. M. & S. Co.

ATLANTIC MINING COMPANY. **MICHIGAN.**

Office: 15 William St., New York. Mine office: Atlantic Mine, Houghton Co., Mich. Employs about 700 men, when working. Organized December, 1872, under laws of Michigan; reincorporated, 1901, for term of 30 years, and capitalization increased, 1902, to $2,500,000, shares $25 par; $9.80 paid in. Annual meeting, second Tuesday in March. American Loan & Trust Co., Boston, transfer agent, Boston Safe Deposit & Trust Co., registrar. Jos. E. Gay, president; John R. Stanton, secretary and treasurer; preceding officers, Wm. C. Stuart, J. Wheeler Hardley, Wm. A. Paine and Samuel L. Smith, directors; Frank McM. Stanton, agent; Theodore Dengler, superintendent; F. G. Coggin, mill superintendent; John Stratton, mining captain; A. D. Edwards, clerk: John Grigg, master mechanic.

Official returns to the state of Michigan, as of date Jan. 1, 1905, disclose the following figures:

Amount of cash paid in on capital stock	$280,000.00
Amount paid in by conveyance of property	700,000.00
Entire amount invested in real estate	20,319.66
Amount of personal estate	457,927.38
Floating debt	107,570.17

Comparative figures for four years are as follows:

	1901	1902	1903	1905
Mineral produced, lbs	6,317,645	6,847,270	7,670,660	5,475,704
Refined copper, lbs	4,666,889	4,949,366	5,505,598	4,049,731
Total income	$ 735,577	$ 588,200	$ 722,386	$ 642,305
Expenses at mine	573,341	535,956	517,384	512,025
Smelting and transp'n	62,954	62,954	64,567	50,321
Interest	.....	.....	4,199	.....
Total cost	636,296	598,910	586,151	562,347
Mining profits	99,281	.....	136,234	64,862
Land sales	11,600	47,788	25,000	.....
Construction	191,143	38,676	10,893	15,095
Balance	—80,262	—1,598	+150,341	+64,862
Dividends	.....	.....	.....	50,000
Surplus	95,699	94,101	244,443	365,220

A dividend of 50 cents per share, amounting to $50,000, was paid February 15, 1905. Last previous dividend was $1 per share, amounting to $40,000, in 1901.

The Atlantic mine proper lies about 2 miles south of Portage Lake and 4 miles southwest of Houghton, the 640-acre main tract including the mines known before 1872 as the South Pewabic and Adams. The Pacific lies on the north, Isle Royale and undeveloped lands on the east and south, and the Pacific and St. Mary's Mineral Land Co. on the west. The Atlantic lands are all on the mineral belt, being the south half of Section 4, except the Southeast quarter of the southeast quarter, the north half of Section 9, and the northwest quarter of the northwest quarter of section 10, all in Town 54 North, Range 34 West. The company also owns all of Section 16, same town

and range, bought 1897, also several thousand acres of timber l a millsite on Lake Superior, and valuable frontage on Portage Lake.

The mine is opened on an amygdaloid bed of brownish, mottled averaging about 15′ width, with strike of N. 50° E., and dip of 54° to to the northwest. The lode is the most westerly worked in Hou county, and is known locally as an ashbed, being in line with the pro southwesterly continuation of the Keweenaw county ashbed, which it re bles. The Atlantic ashbed carries the least copper of any lode now wo successfully, and long has been famous for its profits, wrung from rock y ing much less than 1% ingot copper. The low percentage of copper c by the lode is a decidedly adverse factor, but the mine, under its pr management, has met and survived many discouragements, including rock, mine fires, costly equipment necessitated by deepening shafts, in lation of new machinery, the construction of a new mill, and the buil of a private railroad required for the traffic of the mine. Among ot disadvantages are a wet mine, causing heavy pumping charges, treacherous hanging-wall, necessitating the heaviest timbering used in amygdaloid mine of the Lake Superior district, timbering charges ha been unusually heavy since 1901. To offset all this there are certain ma advantages, the ashbed being the softest rock mined in the district, re ing less power in drilling, less dynamite in breaking, and less steam stamping, than any other lode, and breaking well, while everything is m from wall to wall. Until 1905 no rock assortment was attempted, but the past year rock estimated to carry less than 14 lbs. fine copper p ton has been discarded. Apparently the deepest openings of the mine are rich as the sections nearer surface.

There are 6 shafts, lettered in order from north to south. "A" sha the northernmost, opened 1897, to develop new ground, sunk at an angle 54°, is the largest in dimensions of any shaft, being 9x20′ inside of timb with three compartments. Surface improvements, completed 1899, inclu a wooden shaft-rockhouse, 35x67 on the ground and 84′ high, with four roc crushers, a 38x50′ boiler-house with redstone walls and steel truss roof, a 48x50′ engine-house, of the same construction, containing a 28x4 Corliss engine of Allis-Chalmers make, with double conical drum of 10′ d ameter at either end, and 15′ 6″ in the center, raising 9-ton skips. This sha proved lean, especially in the north drifts, toward the Pacific tract, a careful mill tests proving this the poorest part of the mine, "A" shaft w abandoned in 1904.

"B" shaft, 1,377′ southeast of "A,' with two compartments, is ab 2,200′ in depth, showing good copper ground. Surface equipment is ve complete, including a double conical drum Corliss hoist of Allis-Chalm make, similar in design to the plant at "A" shaft, but much larger throug out, the drum being 12′ at each end and 24′ 4″ in diameter at the midd where there is a cylindrical section 18″ wide, thence tapering sharply in bo directions. The drum has a 22′ face and weighs 140 tons, all grooves bei lathe-turned for 1¼″ steel cable. The hoist is operated in counterbalar

and is good for a depth of 4,000′, 11-ton skips being raised at a speed of 3,400′ per minute. The hoist operates at a steam pressure of 100 pounds to the inch, and is direct-acting and non-condensing, with band brakes at either end, set by gravity and instantaneously released by steam power.

"C" shaft, next southwest, was abandoned after the fire of 1898.

"D" shaft, 1,465′ southwest of "B," 3,000′ in depth, the deepest and best shaft of the mine, is 9x18′ in size inside of timbers, with three compartments, two for skips worked in balance. The engine-house, 48x60′, of redstone with steel truss roof, houses a Nordberg hoist working in balance, capable of hoisting 6-ton skips from one mile depth. The boiler-house has four 150-h. p. Stirling boilers. This shaft looks well and gives promise of good rock for the future, as it commands a large territory, and the bottom levels are the richest, and furnish the bulk of the Atlantic's production. There were seven active levels at the close of 1905.

"E" shaft, 2,440′ deep, is used for a man-way and pipes only.

"F" shaft, 478′ southwest of "D", long was a large producer, but was put out of commission in 1902, at 2,146′ depth.

In 1904 serious trouble was experienced with caving ground and "air-blasts." An air-blast is merely the compression of air in underground openings caused by the fall of considerable quantities of rock in old workings. The trouble became so acute that the management decided to change the entire plan of mining. The operating shafts are to be sunk to the boundary, thence levels run to the extreme length operated, beginning at the bottom, and stoping backwards toward the shafts, using waste rock for filling, so far as possible and permitting the ground to follow in when stoped out. The plan is not one that will present itself to experienced mining men as ideal, being a somewhat undesirable modification of the caving plan, but the Atlantic is facing a crisis, in which its very existence is threatened, and none of the critics have been able to offer a better plan. Any improvement will be thankfully received by the management, which has been sorely put to it by caving ground and drawing shafts. Swapping horses while crossing a stream, or building a new house on the site of an old one while living in the latter, are kindergarten tricks compared with the problem of changing over the plan of operating the Atlantic. The new plan calls for leaving a 20′ floor on each level, and stoping backward to the shafts. To secure rock for mine filling will require considerable underground selection.

In May, 1906, the already tense situation was rendered more acute by the drawing of all operating shafts, which greatly alarmed the miners, and interfered with running the skips. The hanging wall began subsiding from the bottom. This subsidence ended in a few weeks, but was so serious that the mine was closed down. The damage to the old shafts was so great that the mine was yet idle in August, 1906, and it may be found necessary to reopen the mine by entirely new shafts, sunk in the footwall.

Equipment includes a 50-drill Ingersoll-Sergeant air-compressor, machine, carpenter and blacksmith shops, and a sawmill. The principal buildings have fire pumps, and there is an efficient volunteer fire brigade. The village de-

pendent on the mine has about 500 dwellings, half owned by the company, with several churches and one of the best graded schools in the state. The management always has taken a personal interest in the moral and material welfare of its employes, and is rewarded by the confidence and friendship of its workmen, regardless of nationality or creed.

The Section Sixteen tract of the Atlantic, bought 1897, lies next north of the Baltic mine. Exploratory work, 1897-1903, did not reveal the certain existence of the sought-for Baltic lode. On Aug. 31, 1905, the Atlantic and Baltic exchanged parcels of 39 acres each. This trade gives to each outlines by no means artistic, but highly utilitarian, assuring the Baltic a corrected north line, obviating "pocketing" the north drifts from No. 5 shaft, while the Atlantic also avoids being pocketed on its south drifts, and secures the "hinterland" of the Baltic lode, absolutely essential for engine-houses, power plants and general shops. This trade also will enable the Atlantic to sink two shafts, instead of one, on the Baltic lode. The Atlantic resumed work on Section Sixteen in 1905, by working from the sixth level of No. 5 Baltic shaft. A new shaft was sunk also, and in May, 1906, the exploration is beginning to show a little encouragement. The flexure in the Baltic bed, so plainly shown by any attempted correlation of the Baltic and Superior workings, must be very marked on Section Sixteen, hence broken ground may be looked for to some depth, but there are ample grounds for belief that at depth the Atlantic will make a good mine on Section Sixteen. The old mine could furnish full equipment for one new working shaft at the new mine.

The Atlantic Railroad, owned by the company, connects mine and mill with 9 miles of main line, and a 3-mile branch line runs from the mine to the old millsite on Portage Lake, where there are large coal and merchandise wharves for receipt of fuel and supplies. The railroad has 4 Baldwin and 1 Brooks locomotives, 130 hopper cars for rock and coal, and 60 flat-cars for wood and general freight. The mine is on the main line of the Copper Range Railroad also.

The stampmill, built 1895, at Redridge, on Lake Superior, with nearly 2 miles of water frontage, is 151x234′, of wood, on stone foundations. Water is furnished from a dam, described in the article on Baltic. The mill has 6 stamps with 18″ cylinders, of about 400 tons daily capacity each. Chilean regrinding mills are used for the raggings, and round tables have been displaced by Overstroms. Power is supplied by a 14x42″ Reynolds engine of Corliss pattern. There are 7x14x12″ Gardner fire pumps in the mill and boiler-house adjoining. A machine shop in the mill is supplied with all tools required for repair work and fitting. Adjoining the mill is the 71x101′ boiler-house, of wood, on stone foundations. A Green fuel economizer, added 1899, saves about 12% in coal bills. There also are a number of comfortable dwellings for workmen, a 30x36′ frame warehouse, store building and smithy. The mill, like the mine, is very efficiently handled.

Trouble at the mine was reflected in decreased production, amounting, 1905, to 4,049,731 lbs. fine copper, giving an average return of 13.7 lbs. per ton, as compared with 5,321,859 lbs. fine copper in 1904.

The Atlantic suffered an irreparable loss in the death of John Stanton, on Feb. 23, 1906. Identified with American copper mining for more than half a century, Mr. Stanton was, indeed, the Nestor of the industry. His unflagging energy, coupled with his sound sense, and an honesty that was unimpeachable, rendered him a power in the copper world. The Atlantic is left, however, under the management of the sons and associates of Mr. Stanton, and it could not be in better hands.

ATLANTIC & PACIFIC GROUP. **WYOMING.**

Letter returned unclaimed from former mine office, Encampment, Carbon Co. Wyo. Has a 150′ shaft showing a 4′vein of fair grade ore, about 1,000′ from the line of the Ferris-Haggarty mine of the Penn-Wyoming.

ATLAS COPPER SYNDICATE, LTD.

Compulsorily wound up, July, 1901.

ATLAS EXPLORATION & MINING CO. **ARIZONA & MEXICO.**

Office: Douglas, Ariz. R. O. Johnson, president, N. W. Chase, treasurer; D. T. Dunlap, secretary; James Ray, superintendent. Organized June 14, 1902, under laws of Arizona, with capitalization $5,000,000, shares $1 par. Annual meeting, first Tuesday in January. Has undeveloped mineral lands. known as the Atlas group, in the Warren district of Cochise county, Arizona, and a rather promising prospect, about 15 miles south of Douglas, in the northern part of the Arizpe district of Sonora, Mexico, latter showing auriferous copper ore. Idle.

AKTIEBOLAGET ATVIDABERGS KOPPARVERK. **SWEDEN.**

Office and mine: Atvidaberg, Ostergothland, Sweden. Baron Th. Adelsward, president and general manager; Axel Nygren, superintendent; C. A. Rudelius, smelter superintendent. Organized 1900, under laws of Sweden, with capitalization 900,000 kroner, fully paid, shares 1,000 kroner par. Ore is slightly argentiferous chalcopyrite, averaging 2% copper. Has 8 shafts, of 300′ to 1,400′ depth, with about 4,000′ of underground workings. Water power generates electricity that operates the mines and works. Has a concentrator and smelter, at Bersbo, 9 kilometers from mine, with 3 roasting furnaces, 3 reveratory furnaces, and settling tanks for cementation. Mine and works are connected by rail. Production, 1901, was 158,000 kgs. cement copper; 60,959 kgs. refined copper, and 186 kgs. silver. Present production is probably nearly twice as large as in 1901.

GEWERKSCHAFT AUGUSTE I. **GERMANY.**

Mine office: Herscheid bei Barenstein, Westfalen, Germany. Has one shaft, showing lead and copper ores.

KUPPERERZBERGWERK AURORA. **GERMANY.**

Mine office: Huckelheim, Bavaria, Germany. Idle at last accounts.

AURORA MINING CO. **MEXICO.**

Letter returned unclaimed from former mine office, La Cananea, Sonora, Mexico. Is said to have prospected lands near the Greene Consolidated.

AUSTRALIAN COPPER SYNDICATE, LTD.

Voluntarily wound up, February, 1903.

AUSTRALIAN MINING CO., LTD. AUSTRALIA.

Offices: 42, New Broad St., London, E. C., Eng. W. J. C. Cutbill, chairman; Sir. Samuel Davenport, K. C. M. G., Burnside, Adelaide, South Australia, colonial agent; Edgar Collier, secretary. Organized April 30, 1903, as reconstruction of company of same name, chartered 1855, with capitalization £40,000, shares £2 par; issued, £36,644. Paid a 2 shilling dividend, September, 1905. Lands, circa 20,000 acres, in the Reedy Creek district of South Australia, including the Tungkillo mine, which is leased to the Kitticoola Copper Gold Mine, Ltd.

AVENTURERA MINE. MEXICO.

Mine office: Sabinal, Chihuahua, Mex. Britton Davis, general manager. Ore bodies occur irregularly in slate dikes, and carry silver, lead and copper. Mine is opened by shafts, and equipped with steam power. Employed about 100 men men at last accounts.

AVINO MINES OF MEXICO, LTD. MEXICO.

Offices: 137, Salisbury House, London Wall, London, E. C., Eng. Mine office: Avino, Gabriel, Durango, Mex. F. L. Gardner, chairman; F. F. Fuller, secretary; W. B. Jeffrey, general manager; W. A. Jeffrey, assistant manager; W. J. A. Palmer, mine manager. Capitalization £1,000,000, shares £1 par; issued, £953,968. Debentures, £18,800. Was reorganized, Feb. 26, 1903, shareholders being assessed 2s. 6d. and stock marked 17s. 6d. paid, the assessment paying a floating debt of about £50,000 and leaving about £70,000 for development and equipment. About 50,000 shares are owned in the United States. Lands, 252 acres, also a 302-acre damsite, 10 miles from a railroad, carrying a large body of low-grade silicious silver-copper ore, said to have 2,000,000 tons of ore in sight. Mine is said to have produced about $60,000,000, in the past, principally in silver. Values are mainly silver and copper, with a little lead, higest grade ore being shipped to smelter. Has a 650′ shaft, showing oxides and a little native copper in the lower levels, also a 600′ tunnel Has steam and electric power. A large concentrator, built on the property, was found unsuited to the ore, and was replaced by a hyposulphite lixiviation plant of 100 tons daily capacity, which is claimed to save 85% of the silver and 30% of the gold values. Has a 300-h. p., electric plant, operated by a Crocker-Wheeler gas engine. Former management spent too much money on surface and not enough in the mine, and also made a mistake in the plant devised for treatment. This is a very large, low-grade property, requiring skillful and cautious handling, but with good management should make a profitable mine, owing to the great extent of its ore bodies. Idle, in April 1906, from lack of capital.

AZTEC-ALGOMAH DEVELOPMENT CO. MICHIGAN.

Office: care of C. D. Hanchette, Hancock, Mich. Mine office: Greenland, Ontonagon Co., Mich. Organized October, 1905. Property includes the lands formerly held by the Aztec and Algomah mining companies. Property is traversed by the Knowlton lode and lies between the Adventure mine and the property of the Lake Copper Co. The Knowlton lode has been exposed by trenching at various points within a quarter mile, and a shaft was

started thereon, late in 1905. Work was suspended June 30, 1906, owing to inability of the company to secure a renewal of options.

AZTEC COPPER CO. **ARIZONA.**

Letter returned unclaimed from former office, 136 Hartford Bldg., Chicago, Ills. Mine office: Prescott, Yavapai Co., Ariz. E. M. Sanford, attorney. Lands, 20 claims, showing copper ores.

AZTEC COPPER CO. **MICHIGAN.**

Office care of John C. Watson, president, 68 Devonshire St., Boston, Mass. F. W. Morandi, secretary and treasurer. Lands are W. ½ of Section 31, T. 51 N., R. 37 W., area 320 acres, also 920 acres of agricultural and timber lands in Sections 10, 12, and 14, T. 50 N., R. 38 W. Has produced 353 tons, 863 lbs. fine copper, of which 100 tons were secured in a single mass. Idle for many years, until November, 1905, when exploratory work was begun on the Knowlton lode, by the Atzec-Algomah Development Co.

AZTEC COPPER MINING & SMELTING CO. **MEXICO.**

Office: 1309 Stephen Girard Bldg., Philadelphia, Pa. Mine office: Rancho del Almirez, Jalisco, Mexico. Dr. Pemberton Dudley, president; J. F. Graham, secretary; Isaac C. Smyth, Jr., treasurer; Geo. J. Graham, general manager. Organized June, 1901, under laws of New Jersey, with capitalization $300,000, shares $1 par. Lands claimed, 1,000 acres, some fully timbered, including 2 mines, known as La Concha and La Perla, which are being developed by shafts and tunnel. Material for an 80-ton concentrator was being received, early in 1906, and a 25-mile wagon road completed from Ameca to the mine. This company did some very reprehensible advertising early in its career, promising immediate profits, but, of course, no dividends have been paid. Present management apparently is not responsible for the mistakes and lies of its predecessors.

AZTEC GOLD & COPPER MINING CO. **COLORADO.**

Office: 18 Tremont St., Boston, Mass. Mine office: Needleton, La Plata Co., Colo. Employs 10 men. David W. Williams, president; Chas. A. Howland, vice-president; Geo. F. Bradstreet, secretary and treasurer; Josiah Moore, general manager; W. C. Kinney, engineer. Organized Nov. 10, 1899, under laws of Maine, with capitalization $2,000,000, shares $1 par; issued, $976,086. Lands, 19 claims, in 5 groups, lying in the Needle Mountains, circa 16 miles south of Silverton, showing 2 fissure veins in granite and porphyry, these averaging about 2′ width, one, opened by a 1,500′ tunnel, showing argentiferous galena above and copper sulphides below, ores giving assays of $30 to $65 per ton. Equipment includes a 25-h. p. electric motor and 25-h. p. gasoline engine, with a 3,000-h. p. waterfall available for development. Has 7 buildings, and plans extending main tunnel and constructing aerial tram to the concentrator. Property regarded as valuable and management as good.

AZURITE COPPER CO. **ARIZONA.**

Office: Williams, Ariz. Mine office: Willaha, Coconino Co., Ariz. A. Tyroler, president; Olaf H. Prysz, secretary; John S. Green, superintendent. Organized under laws of Arizona, with capitalization $1,500,000, shares $1

par. Lands, 10 claims, in the Francis district, on the line of the Santa Fé & Grand Canyon railroad, showing promising ore bodies. Presumably idle.

AZURITE COPPER & GOLD CO. **ARIZONA.**

Dead. Lands sold to Mineral Hill Consolidated Copper Co.

AZURITE MINING CO. **WYOMING.**

Office: 365 Tenth St., Oshkosh, Wis. Mine office: Dillon, Carbon Co., Wyo. Henry L. Larsen, president; Arthur Bishop, vice-president; H. O. Granberg, secretary, treasurer and general manager; E. N. Sanders, superintendent; Frank Earle, consulting engineer. Organized Dec. 17, 1904, under laws of Wyoming, with capitalization $1,000,000, shares $1 par; issued, $635,000. Lands, 5 claims, area 100 acres, in the Battle Lake district. Country rocks are limestone, quartzite and gabbro, showing 3 fissure veins in latter, these averaging 15′ to 20′ width, and giving assays of 18% copper, from a 65′ shaft and a 70′ tunnel.

BABCOCK & KITTERMAN GROUP. **OREGON.**

Mine office: Althouse, Josephine County, Oregon. A prospect, on which limited development work has shown ore giving good assay values. Idle.

BABY McKEE GOLD MINING CO. **OREGON.**

Mine office: Sumpter, Baker Co., Ore. L. G. Lilley, manager, at last accounts. Ores carry gold silver, lead and copper. Has steam power.

BACHELOR GOLD MINING CO. **COLORADO.**

Mine office: Lake City, Hinsdale Co., Colo. C. F. Meek, superintendent. Ores carry gold, silver, lead and copper. Has water power.

BACKUS & JOHNSON. **PERÚ.**

Office and works: Casapulca, Oroya, Perú. Has a small but well-equipped and thoroughly modern smelter, said to be second in Perú only to the great plant of the Cerro de Pasco. Ores treated are mainly from small independent mines of the Cerro de Pasco district. Works are located 88 miles from Lima, at an altitude of 13,606′. Ores under 12% are not treated. German and English coke is used for fuel, and product is exported, as a 50% matte.

BADEN-BADEN GOLD MINING CO. **COLORADO.**

Office: 324 Cooper Bldg., Denver, Colo. Mine office: Black Hawk, Gilpin Co., Colo. Newell Bros., managers. Mine has auriferous and argentiferous copper ores, with steam power.

BADGER COPPER CO. **WYOMING.**

Letter returned unclaimed from former office, Laramie, Wyoming Organized, 1902, to operate in Albany county, Wyoming.

BADGER MINE. **COLORADO.**

Mine office: Pearl, Larimer Co., Colo. Is on the Platte river, 12 miles east of Pearl. Owned by Alex. Hilton, et al. Has a limited amount of development work, giving a fair showing of high-grade ores.

BADGER STATE MINING & MILLING CO. **WYOMING.**

Office and mine: Saratoga, Carbon Co., Wyo. Gustav Jensen, president and manager; John H. Davis, vice-president and superintendent; C. E, Jensen, treasurer; A. H. McDougal, secretary. Organized December 26, 1901, under laws of Wyoming, with capitalization $1,000,000, shares $1 par. Lands,

8 claims, area 140 acres, on Jack Creek, showing 3 fissure veins, averaging 4′ width, claimed to give average assays of 50% copper, 50% lead and from a trace up to 400 oz. silver per ton, opened by shafts of 60′ and 105′, and by a 90′ tunnel.

BAGDAD GOLD & COPPER CO. **CALIFORNIA.**

Office: care of Gordon & Co., 254 Wilcox Bldg., Los Angeles, Cal. Mine office: Bagdad, San Bernardino Co., Cal. Sherman Washburn, president; V. L. Carroll, secretary. Is a prospect only, with about 250 feet of openings. Idle.

BAHIA EXPLORATION CO. **BRAZIL.**

Has sundry claims circa 50 miles west of Jaguarary, Brazil, showing ores assaying 2% to 4% copper.

BAKER CONSOLIDATED COPPER MINING CO.

Office: 4 Campau Bldg., Detroit, Mich. John Baker general manager. Organized under laws of District of Columbia, with capitalization $2,500,000. Location of property, if any, not known. Is regarded with suspicion.

BAKER MILLING, SMELTING & REFINING CO.

Office: 4 Campau Bldg., Detroit, Mich. John Baker, president; John E. Rolland, secretary and treasurer. Organized under laws of Oklahoma, with capitalization $10,000,000. President claims to be putting a plant in Detroit, to be in operation during 1906. Is regarded with suspicion.

BALACLAVA COPPER MINING CO. **AUSTRALIA.**

Mine office: Broken Hill, N. S. W., Australia. W. O. H. Simons, superintendent, at last accounts. Has auriferous copper ores.

BALADE MINE. **NEW CALEDONIA.**

Mine office: presumably Noumea, New Caledonia. Discovered 1884. Ores are concentrated up to 17% to 20% copper, when working. Presumably idle.

BALAKLALA CONSOLIDATED COPPER CO. **CALIFORNIA.**

Office: 60 State St., Boston, Mass. Mine office: Kennett, Shasta, Co., Cal. Joseph A. Coram, president; Clarence K. McCornick, treasurer, C. O. Ellingsworth, secretary; Duncan McVichie, general manager; Robeson White, smelter superintendent. Capitalization $1,000,000, shares $5 par. Control of company was sold twice, and a reorganization was required to untangle matters, present company succeeding the Balaklala Mining Co.

Lands, 64 claims, adjoining the Trinity. Principal development is on El Capitan group, opened by tunnels, showing a sulphide ore body 60′ to 100′ wide, on the 400′ level, ore ranging from very poor to very good, and claimed to show an average of better than 11% copper, but placed more conservatively at about 3.7% copper, with small gold and silver values. Property has been extensively probed by diamond drills, which have shown several large deposits, about 100′ below the body opened by tunnel. Ore occurs in lenses, the largest being estimated as 50x500x700′ in size. Mine is claimed to have 300,000 tons of ore in sight, which probably should be scaled about one-third.

The company's smelter site, area 320 acres, between Kennett and Shasta, is in Section 20, located Nov. 1, 1905, on an Indian allottment thrown open 20 days later, so title does not seem quite clear. Smelter is planned for 3

units of 2,100 tons aggregate capacity. First unit, of 700 tons, is expected to go into blast in 1907.

BALAKLALA MINING CO. **CALIFORNIA.**

Succeeded, circa 1904, by Balaklala Consolidated Copper Co.

BALD MOUNTAIN MINING CO. **WASHINGTON.**

Mine office: Clear Lake, Skagit Co., Wash. A. H. Rogers, superintendent, at last accounts. Idle.

BALHANNAH COPPER & GOLD MINE, LTD. **AUSTRALIA.**

Dead, though apparently not buried.

BALHANNAH MINE. **AUSTRALIA.**

An old mine, at Onkaparinga, South Australia, 14 miles southeast of Adelaide. Ores carry copper, lead, zinc, silver, gold and bismuth. Idle for many years.

BALKAN COPPER CORPORATION, LTD. **TURKEY.**

Offices: Chiswell House, Finsbury Pavement, London, E. C., Eng. Sir Owen R. Slacke, chairman; Ernest A. Foster, secretary; Mario Krieger, managing director in Turkey. Organized Sept. 5, 1899, with capitalization £250,000, shares £1 par; issued, £220,000. Property is the Yardimly copper mine, area 7,900 acres, and the Chapzi-Hane mine, area 2,500 acres, in the Rhodope Mountains, northwest of Constantinople, held on an annual rental of £420, plus 5% royalty on gross earnings. Idle for several years.

BALLA BALLA COPPER MINES, LTD. **AUSTRALIA.**

Reorganized, April 16, 1901, as New Balla Balla Copper Mines, Ltd.

BALLARAT COPPER MINING CO. **WASHINGTON.**

Mine office: Newport, Stevens Co., Wash. Ores carrying copper, gold and silver, have been opened by a crosscut tunnel. Idle at last accounts.

BALLARAT & LYELL MINES, LTD. **TASMANIA.**

Offices: Broad Street House, London, E. C., Eng. Herbert Allen, chairman; M. V. Ward, secretary. Organized, Jan. 23, 1903, as a reconstruction of the Great Mt. Lyell Copper Co., Ltd., with capitalization £250,000, shares £1 par; issued, £51,000. Debentures, £1,000. Apparently now holds no copper property in Tasmania.

BALSAS MINES. **MEXICO.**

Sundry properties, said to be located not far from Inguarán, in the state of Michoacán, Mexico. Alleged to be operated by German capitalists, but no trace of active operations found.

BALTIC MINING CO. **MICHIGAN.**

Office: 27 State St., Boston, Mass. Mine office: Baltic, Houghton Co., Mich. Employs about 800 men. Wm. A. Paine, president; Frederick Stanwood, secretary and treasurer; preceding officers, Joseph E. Gay, Samuel L. Smith and Cameron Currie, directors; F. W. Denton, superintendent; C. G. Mason, engineer; Martin Trethewey, mining captain; Wm. C. Cole, clerk; F. G. Coggin, mill superintendent; W. J. Richards, master mechanic. Organized December, 1897, under laws of Michigan, with capitalization $2,500,000, shares $25 par, $18 paid in. Began dividends 1905, with disbursements of $1,250,000. Annual meeting, first Monday in March.

Practically the entire stock issue of the Baltic is owned by the Copper Range Consolidated Company.

Official returns to the state of Michigan, as of date Jan. 1, 1905, disclose the following figures.

Amount of cash paid in on capital stock	$1,800,000.00
Amount paid in by conveyance of property	1,000,000.00
Entire amount invested in real estate	1,014,751.00
Amount of personal estate	820,120.31
Amount of floating debt	144,452.65

Lands, 800 acres, near the Eastern Sandstone of the Keweenawan copper belt, about 75 acres being on the sandstone and non-mineralized. Holdings comprise all of Section 21 except the southeast quarter, also the west half of Section 20, Town 54 North, Range 34 West. Lands are bounded on the north by the Wheal Kate and Section Sixteen of the Atlantic; on the east by St. Mary's Mineral Land Co.; on the south by St. Mary's lands, lands of Hussey, Howe & Co. and the Trimountain mine; on the west by the Trimountain. In 1905 exchanged parcels of 39 acres with the Atlantic mine, which will enable the Baltic to sink No. 5 shaft to much greater depth than otherwise possible. The Baltic is 2½ miles due south of the Atlantic, and its northernmost shaft is not quite 4 miles south of No. 10, the southermost shaft of the Huron mine of the Isle Royale. To the southward the Trimountain and Champion mines are opened on the same lode, which has a strike of N. 63° E., from Baltic shafts 2 to 5, and to the northward the Superior mine is being developed on the same bed. The dip of the lode averages about 73°, being the sharpest of any developed cupriferous bed in the Lake district.

The Baltic shafts are numbered from south to north, and there is a distance of 3,025′ between the extreme shafts, with room for one additional shaft at each end, though a possible No. 6 would be cut off at comparatively shallow depth by the Section 16 tract of the Atlantic, hence it is probable No. 5 will remain the northernmost shaft.

No 1, the discovery shaft, located between Nos. 2 and 3, was sunk at a wrong angle, and was abandoned at a depth of 219′.

No. 2 shaft, the southernmost, was 725′ deep at the close of 1905, and was showing very promising ground. Production from No. 2 is planned to begin in the spring of 1906. The equipment, added 1905, includes engine-house, boiler-house, compressor building, steel rock-shafthouse and a new hoist. The boiler-house has two 250-h. p. Stirling water-tube boilers, and the compressor has capacity to reduce 4,000′ of free air per minute to a pressure of 70 lbs. per square inch.

No 3 shaft, 1,170′ northeast of No. 2, and 1,200′ deep at end of 1905, has a steel, sheathed frame shaft-rockhouse, 36x71′, with 17x31′ wing, 88′ high, with 1,400-ton rock-bins, fitted with a 16x18″ engine, and two 18x24″ Blake crushers.

No. 4 shaft, 900′ northeast of No. 3, was 1,150′ deep at close of 1905, with duplicate shaft-rockhouse of No. 3, and a 5,000′ Nordberg conical hoist.

No. 5 shaft, the northernmost, is 855′ northeast of No. 4, and was 910′

deep at close of 1905. Shaft-rockhouse is a duplicate of those at Nos. 3 a 4. Hoist is a duplex Nordberg, good for 1,500′. The ground was co erably disturbed in the upper levels of No. 5, but is growing more so at the bottom, the showing of the tributary openings ranging from poo good, with improvement at depth.

The Baltic amygdaloid, taking its name from the first mine opened i it, was first found in 1882, but was abandoned at 90′ depth, because a hole, pitched at a wrong angle, ran into the hanging-wall. The Balti an exceptionally strong lode, ranging from 15′ to 60′ in width, so well m eralized that at most points it must be more or less thoroughly beaten s from wall to wall. The great width of the stopes has brought about the of a walling system, by which waste rock is built into dry-walls along drifts, thus saving timbering, while giving stronger walls than any ti could supply, and saving the cost of hoisting lean rock. The walling syst of the Baltic has proven a success under actual test. A little melaconi found in narrow fissure veins crossing the lode, these being too small to fol but the black oxide ore mined in the stopes is saved in the milling, carry 35% to 40% copper as dressed, and smelts readily with the native co mineral. The native copper of the Baltic is arsenical, and it is probable t a small amount of copper arsenides are mined and milled, as narrow arse fissure veins occur occasionally in the district south of Portage Lake. Wh the finished copper is arsenical, it makes wire of great tensile strength.

The compressor-house, between shafts 3 and 4, is 36x58′ in size, w concrete foundations, stone walls and steel roof, housing a compressor w capacity to reduce 4,000 cubic feet of free air per minute to a pressure 70 lbs. per inch. Adjoining is a boiler-house of similar material, 49x70′, w wing 12x62′, having four 250-h. p. Stirling water-tube boilers and a 1 self-supporting steel smokestack. This boiler plant supplies steam for sha 3 and 4. Adjoining the boiler-house is a 360′ coal trestle, with storage c pacity of 5,000 tons, underneath being a 5x8′ concrete tunnel, through wh coal is hauled in tram-cars, on a down grade, by an endless cable. An exte sive coal trestle was built at No. 2 shaft in 1905. There is a 50x132′ com nation machine-shop and smithy, with stone walls and steel roof, a 42x carpenter shop, a 30x90′ miners' changing house, supplied with hot and co water, bath-tubs and lockers, a good office building and about 100 well-bu dwellings for employes. The mine has a complete electric light plant. considerable town has grown up about the mine, on lands owned by the com pany. The mine and town are served by the Painesdale branch of the Co per Range railroad, and also are reached by a branch of the Atlantic railway

The stampmill, at Redridge, on Lake Superior, one half mile west of th Atlantic mill, went into commission December, 1901. The mill proper is 175x195′, of structural steel, on stone foundations, with 4 Nordberg stamps having 20x24″ cylinders, capable of crushing about 500 tons each, daily. Foundations for the stamps are very massive, the use of timber having been dispensed with, and 90-ton anvil plates set beneath the mortars. Eight Wil fley concentrators have displaced finisher jigs and slime-tables. A com-

pound condensing Corliss engine runs the 4 stamps and washing machinery. The discharge at the mill is 25′ above mean water datum, and, with the usual drop of one in ten, provides for the wasting of many millions of tons of tailings by gravity alone. The mill is heated by the Coogan & Strothenke system, air being delivered from 4 blowers, after previous heating by passing over steam-coils, radiation in the coils being insured by the vacuum system. Adjoining the mill is a 55x90′ boiler-house, of steel frame on stone foundations, housing five 250-h. p. Stirling water-tube boilers, and a Green fuel economizer. Draft is secured by a set of duplex fans, driven by the mill engine. Behind the boiler-house is a 25,000-ton coal-storage yard, for the joint use of the Baltic and Atlantic mills, coal being brought to the boilers through tunnels, by gravity. The mill has centrifugal crushing rolls and a Huntington mill for regrinding.

Water for both the Baltic and Atlantic mills is furnished by a $150,000 gravity dam across the mouth of Salmon Trout river, built jointly by the Atlantic and Baltic mines. This structure is built of steel and anchored by its own weight, irrespective of the holding power of the rock. The plan was suggested by J. F. Jackson, of the Wisconsin Bridge & Iron Co., and the details were inspected and approved by Foster Crowell, who acted as consulting engineer during construction of the dam by the Wisconsin Bridge & Iron Co., and Prendergast & Clarkson, the completed work requiring about 1,000,000 pounds of steel and 8,000 cubic yards of concrete work. The dam impounds about 1,250,000,000 gallons of water, and at the river's lowest stage can furnish water to wash 5,000 tons of rock daily, 300 days each year, effecting a saving over pumping of about 2 cents per ton of rock stamped. The dam is anchored in a cement foundation of great strength, and is in five sections, with a total length of 475′, the central or deepest section being 74′ high, with wings of 200′ on the west and 350′ on the east, these being in comparatively shallow water, and made with cement cores built up from excavations in bed-rock, buttressed by earth embankments. The five sections of the dam proper are all of the same general design, the central section being highest, as it is bottomed in the bed of the river, and having a wider and heavier concrete base, with a stronger steel bracing. The dam is of steel throughout, anchored in a concrete base, with braces between the crest of the dam and the extreme foot of the cement base. The following description of the central section will give an idea of the general construction of all five parts: the concrete base is 62′ wide, built up from rock excavations. The resultant of all pressures gives a pressure of 2,626,000 pounds for each steel section of 8′ width and 74′ height. The upper 50′ of the dam in this central section of 100′ is inclined from the water at an angle of 45°, throwing the point of overturning within the central third of the concrete base, thus allowing an ample margin of safety. The dam is made of plates of best boiler steel, concave on the water side, 8x16′ in size and 3-8″ thick, riveted and caulked water-tight and supported by parallel inclined "I" beams 24″ thick, for the full depth of 50′ below the crest of the dam. On the lower section the steel plates are each 8x16′ and 3-16″ thick, concave, riveted and caulked, but resting directly against the concrete base.

The "I" beams of the upper or main section are supported by heavy triangular frameworks of inclined steel columns and struts. The entire steel structure is anchored to a 2″ steel base-plate, at the bottom of the concrete, by a large number of 1.5″, 2″ and 2.5″ steel rods, of 15′ to 30′ length. Water is taken from the dam about 20′ below the crest by three 38″ riveted steel pipes, one pipe being on the Atlantic and two on the Baltic side. There is a system of valves and waste weirs, but the structure is of such a nature that it could not be injured were water to flow continuously over its crest for an indefinite period. Surmounting this structure is a trestle of the Copper Range railroad, built at the same time, but in nowise a portion of the dam. The center of the railroad track is 7′ above the crest af the dam, 10′ down-stream. In the central sections the foundations for the feet of the trestle are all in the concrete work, elsewhere the northern piers for the trestle are separately built.

The Baltic began production with a leased stamp, August, 1899. The Baltic mill was started, with one stamp Dec. 19, 1901. A second stamp was put into commission February, and a third August, 1902, the fourth and last stamp starting on Baltic rock in 1903. The growth of the Baltic is best shown by its figures of production: the mine made 2,641,432 lbs. fine copper in 1901; 6,285,819 lbs. in 1902; 10,580,997 lbs. in 1903; 12,177,729 lbs. in 1904 and 14,384,684 lbs. in 1905. Net earnings were $397,629.17 in 1903, and $1,059,165.09 in 1905. At the close of 1905 rock shipments were approximately 50,000 tons per month. No. 2 shaft, when in commission, should add about 25% to the rock production and feed the mill to its utmost capacity. In 1907 the production should be approximately 16,000,000 lbs. fine copper, and the matter of enlarging the mill must be considered soon. To predict the ultimate productive capacity of the Baltic would not be safe. It is at least certain that the mine can double its present output, eventually. The Baltic is a very fine mine, with a highly capable management, and a future that is full of promise.

BALTIMORE COPPER-GOLD MINING CO.

Office: London, Ontario.

BALTIMORE COPPER, SMELTING & ROLLING CO. **MARYLAND.**

Office and works: Keyser Bldg., Baltimore, Md. Plant is located on the Baltimore water-front, enjoying one of the best harbors on the Atlantic coast, with direct rail connections, being very advantageously situated for handling both domestic and foreign business. Plant is modern throughout, including large electrolytic works, bullion refinery, sheet-copper rolling-mill and a bluestone plant for making copper sulphate. Material treated is mainly auriferous and argentiferous copper matte from Arizona, Montana and various foreign countries. Management is progressive.

BALTIMORE & SONORA GOLD & COPPER CO. **MEXICO.**

Office: 909 Maryland Trust Bldg., Baltimore, Md. J. O. Johnston, president; Chester F. Johnston, secretary. Capitalization $5,000,000, shares $10 par. Lands, 387 acres, in the Arizpe district of Sonora, Mexico, on the western slope of the Cananea Mountains, showing large and promising outcrops of carbonate and silicate copper ores. Presumably idle.

BALVANERA MINING CO. **MEXICO.**

Office: 24 Broad St., New York. Herbert T. Beatty, president, and Chas. W. White secretary and treasurer, at last accounts. Lands, 46,000 acres, in the Ocampo and Concheño districts of Chihuahua. Is controlled, through ownership of majority of stock, by the Greene Gold-Silver Co.

BAMBERGER-PIOCHE MINING CO. **NEVADA.**

Office: care of Simon Bamberger, president, Salt Lake City, Utah. Mine office: Pioche, Lincoln Co., Nev. Edward Cutts, superintendent. Lands, 12 claims, lying to the westward of the Nevada-Utah. It is planned to utilize the old Phœnix shaft of the Raymond-Ely mines, for the development of the present company's holdings.

BANNER GOLD & COPPER MINING CO. **WASHINGTON.**

Mine office: Chelan, Chelan Co., Wash. Dr. J. L. Jacobs, president; R. W. Eager, secretary. Main tunnel, 101′, showing ores assaying up to 18% copper and $15 to $33 gold per ton. Presumably idle.

BARAGUNDA MINES. **INDIA.**

Mine office: Baragunda, Hazaribagh, Bengal, India. Were operated, 1887 to 1891, turning out about 1,000 tons of copper in five years. Ore occurs as chalcopyrite, running only 1% to 3% copper, in a gangue of micaceous schist. All ore treated was carted 24 miles to the smelter, at Giridhi. These are perhaps the most promising copper properties now known in India, despite the low grade of the ore, and might be worked successfully, if given rail facilities, adequate capital and good management.

SUCESION DE BARAZARTE. **CHILE.**

Letter returned unclaimed from former mine office, Paposo, Taltal, Atacama, Chile. Property includes the Reventon mine, 400′ deep, and the Abundancia mine, 380′ deep, both opened in 1830, also La Unión mine. Has steam power.

BARE HILL MINE. **MARYLAND.**

Office: care of Albert Smyser, owner, York, Pa. An old property, at Mt. Washington, Batimore county, Maryland, showing slightly auriferous and argentiferous chalcopyrite and bornite. Idle for some years.

BARISTE COPPER CO. **MEXICO.**

Office: 87–84 Adams St., Chicago, Ills. Mine office: Agua Caliente de Baca, Sinaloa, Mexico. Employs 6 men. A. W. Davis, president; J. E. Richardson, vice-president; H. A. Clapp, secretary and general manager; E. R. Austin, treasurer; D. H. Livingston, superintendent; H. B. Clapp, engineer. Organized February 23, 1906, under laws of Arizona, with capitalization $2,000,000, shares $1 par. Lands, 24 pertenencias, area 59 acres, in the Alamos district, showing lenses of ore giving assays up to 20% copper and 40 oz. silver per ton, with small gold values, from oxide, carbonate, and sulphide ores. Management plans driving a 1,000′ tunnel.

BAROTSE COPPER CO., LTD. **RHODESIA.**

Merged, 1902, in Rhodesia Copper Co., Ltd.

BARRANCA COPPER CO. **MEXICO.**

Office: 170 Broadway, New York. Mine office: Barranca del Cobre,

Chihuahua, Mexico. H. T. R. Cowell, manager. Operates La Pu... mine, producing copper, gold and silver. Main shaft, 750′, main t... 2,100′. Has water power, 20-stamp mill, two 4′ Huntington mills, a ... concentrator, completed 1905, and a 60-ton smelter. Management ... to begin shipping concentrates as soon as the Kansas City, Mexico & O... Railway reaches Cuesta Prieta, to nearly which point track was l... March, 1906

BARSTOW MINES. COLORA...

Mine office: Ironton, Ouray Co., Colo. John Geisel, superintende... last accounts. Ores carry gold, silver and copper.

GEWERKSCHAFT BARTHOLOMÄUS. GERMA...

Office: Düsseldorf, Germany. Mine office: Wenden bei Olpe, West... Germany. Produces argentiferous tetrahedrite and manganiferous sp... iron ore. Has a 65-metre shaft.

BASIN & BAY STATE MINING CO. MONTA...

Mine office: Basin, Jefferson Co., Mont. Has a large concentra... leased to La France Copper Co.

BASIN-COMSTOCK CO. MONTA...

Mine office: Cataract, Jefferson Co., Mont. Organized 1904, w... capitalization $500,000, by Wm. A. Kidney, et al. Lands, sundry cla... held under bond and lease, having a 340′ shaft showing stringers of ore.

BASIN GOLD & COPPER MINING CO. MONTA...

Office: care of E. R. Holden & Co., 20 Broad St., New York. M... office: Basin, Jefferson Co., Mont. Robt. B. Smith, president; M. L. Hew... vice-president and general manager; B. Lowinson, secretary and treasu... Lands, 280 acres, patented, known as the Hope mine, on which considera... development has been secured. Company is entangled in litigation, wi... scant prospects of disentanglement.

BASIN REDUCTION CO. MONTA...

Works office: Basin, Jefferson Co., Mont. Has some sort of close con... nection with the Basin & Bay State Mining Co. Supplies light and wate... to the town of Basin. Said, January, 1906, to plan development.

BASLER MINING & DEVELOPMENT CO. CALIFORNIA...

Office: 904 J St., Sacramento, Cal. Mine office: Lowry, Tehama Co., Cal. Employs 8 men. Dr. D. L. McLean, president; W. L. Rennie, secre... tary and treasurer; C. M. Basler, general manager; H. Anchor, engineer. Organized under laws of California, with capitalization $200,000, shares $1 par. Lands, 14 claims, partly patented, also a 5-acre millsite and 320 acres miscellaneous lands, opened by a 1,200′ tunnel, with 3,000′ of underground openings, showing 3 ore bodies, one of 2′ to 75′ width giving average assays of 2% copper, 2% lead, and $1 to $3 gold per ton, from malachite, bornite and chalcopyrite. Company plans continuing development work, which seems to have been done along sensible lines in the past.

BASSETT MINES, LTD. ENGLAND.

Office and mines: Bassett Mines, Redruth, Cornwall, England. Henry Trembath, chairman; Richard Rendle, secretary; Wm. James mine manager

Capitalization £120,000, shares £1 par; issued, £117,500. Lands, 960 acres, at Illogan. Is primarily a tin mine, but produces a little copper. Is developed by shafts and has steam power and a stamp-mill.

BATCHELDER MINE. **WYOMING**

Office: care of F. E. Brown, Omaha, Neb. Mine office: Dillon, Carbon Co., Wyoming. Is slightly developed by a shaft.

JOHN BATES. **BOLIVIA.**

Office and mine: Coro Coro, La Paz, Bolivia. Works a conglomerate, carrying native copper. Has steam power.

BATES MINING & SMELTING CO. **MASSACHUSETTS.**

Letter returned unclaimed from former mine office, Charlemont, Franklin Co., Mass. Described in Vols. IV and V.

BATTLE COPPER MINING CO. **WYOMING.**

Office: care of Delaney & Delaney, Colorado Springs, Colo. Mine office: Battle, Carbon Co., Wyo. W. H. Baker, president; J. V. Helm, secretary and treasurer; W. C. Leadbetter, general manager. Organized 1898, under laws of Colorado, with capitalization $1,500,000, shares $1 par. Lands, 3 patented claims, area 54 acres, known as the Portland mine, showing 9 contact veins with estimated average width of 30′, length 2,000′ and estimated average value of 11% copper and $4 to $40 gold per ton. Ore is sulphide. Has 13 shafts, of 10′ to 218′, and a 370′ tunnel, latter said to show 35′ of 3% copper ore. Has a 6x8″ Fairbanks & Morse hoist and a 40-h. p. boiler. Is on the line of the Penn-Wyoming aerial tram.

BATTLE LAKE & BATTLE CREEK MINING CO. **WYOMING.**

Office: care of N. B. Noble, Rice Lake, Wis. Mine office: Battle, Carbon Co., Wyo. Presumably idle.

BATTLE LAKE COPPER EXPLORATION CO. **WYOMING.**

Office: 25 East Pike's Peak Ave., Colorado Springs, Colo. Moribund.

BATTLE LAKE TUNNEL SITE MINING CO. **WYOMING.**

Control sold, 1906, to Penn-Wyoming Copper Co.

BATTLE MOUNTAIN COPPER MINING CO.

Letter returned unclaimed from former office, 60 State St., Boston, Mass.

BATTLESHIP MINING & MILLING CO. **NEW MEXICO.**

Office: 412 Mack Bldg., Denver, Colo. Mine office: Lordsburg, Grant Co., N. M. Dr. O. L. Blachly, president; O. B. Crum, secretary and treasurer. Capitalization $100,000, shares $1 par. Lands, 2 groups of 2 claims each, area 79 acres, in the Virginia district, three to four miles from Lordsburg, connected therewith by a good wagon road. Property has no surface improvements, and is opened by 478′ of shafts, crosscut and opencut, showing ores that have given average returns, from smelter shipments to El Paso, of 8% to 14% copper, 1% to 20% lead, 22 oz. silver and $10 to $20 gold per ton.

BAUMANN COPPER CO. **ARIZONA.**

Office: care of Geo. W. Johnson, president, Moline, Ills. Mine office: Humboldt, Yavapai Co., Ariz. Employs 14 men. Jules Baumann, general

manager; C. H. Dooley, secretary; J. E. Burmeister, treasurer; W. H. Mackay, superintendent.

Organized Aug. 3, 1901, under laws of Arizona, with capitalization $600,000, shares $1 par. Commercial Trust Co., of Prescott, registrar and transfer agent. Annual meeting, first Monday in November. Lands, 25 claims, area 500 acres, unpatented, in the Agua Fria district, including the Swiss Girl mine. Country rocks are quartz-porphyry and slate, principal veins occurring as fissures in quartz-porphyry, with heavy gouge on footwall. Ores are cuprite, malachite and azurite above, with chalcopyrite below, giving assays of 14% to 42% copper, from a trace to 312 oz. silver, and from a trace to $33.50 gold per ton. Development is by 11 shafts, three of 208′, 214 and 690′, with 8 under 200′ depth, and by tunnels of 50′, 150′, 200′, and 305′, with a total of 2,650′ of underground openings. Equipment includes a 25-h. p. hoist, good for 1,500′, an 80-h. p. boiler, 2-drill Sullivan air-compressor, 2 power drills and several small mine buildings. Management plans drifting and crosscutting from the 725′ level of the Swiss Girl shaft, when that depth is reached. Management seems honest and capable, and the property is of considerable promise.

SOCIEDAD MINERA y FUNDICION DE BAUSCH y TIANI. **ARGENTINA.**

Office, mine and works: Chilecito, Rioja, Argentina. Property includes the San Pedro, Mercedes and other mines, producing copper, silver, and lead. Has water and steam power and operates the "San Miguel" smelter.

BAXTER MINE **CALIFORNIA.**

An idle prospect near the Bully Hill mine, Redding, Shasta Co., Cal.

BAY COPPER MINES, LTD.

Offices: 142, Palmerston House, London, E. C., Eng. John Robertson, managing director; W. R. Caldwell-Moore, secretary. Organized Jan. 24, 1902, with capitalization £35,000, shares £1 par; issued, £15,007. Claims to own an idle copper mine, but whereabouts of same not ascertained.

BAY HORSE COPPER MINING CO. **WYOMING.**

Mine office: Riverside, Carbon Co., Wyo. W. G. Foss, superintendent. Lands, sundry claims, circa 12 miles south of Encampment, on which some little development work has been done.

B. C. MINE. **BRITISH COLUMBIA.**

Described under title British Columbia Chartered Co

BEAD LAKE GOLD-COPPER MINING & MILLING CO. **WASHINGTON.**

Office: care of W. E. Allen, secretary, Stevens Point, Wash. Mine office: Newport, Stevens Co., Wash. Employs 6 men. B. F. Seeley, president; O. L. Smith, superintendent. Organized 1901 under laws of Washington, with capitalization $3,000,000, shares $1 par. Lands, 13 claims, area 267 acres, developed by a 2,065′ tunnel, showing sulphide ore. Has steam power and air-compressor. Is exploring by diamond drill.

BEAN COPPER CO. **ARIZONA.**

Letter returned unclaimed from former mine office, Gila Bend, Ariz.

BEAR CREEK MINING CO. **CALIFORNIA.**

Office: 18 Naylor-Cox-Bldg., Terre Haute, Ind. W. R. McKeen, presi-

dent; A. W. Wright, managing director; Willard Kidder, treasurer; Henry C. Albrecht, secretary. Property is in Mariposa county, California. Idle.

BEAR GULCH MINING CO. **MONTANA.**

Office and mine: Twin Bridges, Madison Co., Mont. Alex. Johnson manager; Edson C. Baxter, superintendent. Property is the Mountain View group, carrying auriferous and argentiferous copper ores, opened by tunnel. Has steam power.

BEAR MOUNTAIN MINING & DEVELOPMENT CO. **WASHINGTON.**

Mine office: Colville, Stevens Co., Wash. C. G. Carruthers, superintendent. Has argentiferous and auriferous copper ore, opened by tunnel.

BEAR MOUNTAIN TUNNEL & MINING CO. **COLORADO.**

Mine office: Crystal, Gunnison Co., Colo. H. H. Williams, superintendent, at last accounts. Has argentiferous and slightly auriferous copper ores, opened by tunnel, with water power.

BEATRICE MINING & MILLING CO. **MONTANA.**

Mine office: Elliston, Powell Co., Mont. D. G. Barringer, president; A. McNaughton, secretary and general manager; Abner Knapp, superintendent. Has ores of gold, silver, lead and copper, opened by tunnel. Has steam power.

A. K. BEATSON. **ALASKA.**

All business of the Latouche Mining Company is done in the name of A. K. Beatson.

BEAVER-CAÑON GOLD & COPPER MINING CO. **WASHINGTON.**

Mine office: Loomis, Okanogan Co., Wash. E. P. Gaillac, manager. Lands, sundry claims, circa 8 miles south of Loomis.

BEAVER CONSOLIDATAED MINING CO. **UTAH.**

Merged, 1904, in Beaver-Harrison Mining Co.

BEAVER COPPER MINING CO. **WYOMING.**

Letter returned from former mine office, Downington, Carbon Co., Wyo., with notation "dissolved." Described in Vol. V.

BEAVER-HARRISON MINING CO. **UTAH.**

Office: 23 Eagle Block, Salt Lake City, Utah. Mine office: Milford, Beaver Co., Utah. J. J. Trenam, president and manager; E. H. Jacobs, treasurer; B. L. Corum, secretary. Organized 1904, with capitalization $75,000, shares 5 cents par. Is a merger of the Beaver Consolidated Mining Co. and the Ben Harrison Gold & Copper Mining & Milling Co. Lands, 21 claims, area 385 acres, Beaver Lake district, one group being near the O. K. mine of the Majestic company, showing sundry fissure veins, opened by 2 shafts of 300′ and 534′, with about 2,000′ of workings, showing a 10′ ore body assaying 5% to 50% copper, and up to 10 oz. silver and $7 gold per ton. Has steam power and an air-compressor, with necessary mine buildings. Employs about 20 men. Property regarded as promising

BEAVER LAKE COPPER CO. **PENNSYLVANIA.**

Mine office: Bloomsburg, Columbia Co., Pa. Has secured ores assaying 17% copper. Presumably idle,

BEAVER MOUNAIN MINING CO. ALA

Mine office: Sulzer, Prince of Wales Island, Alaska. Henry Miller, p dent, Geo. Comer, manager. Lands, sundry claims on the south side of Ba Mountain, Hetta Inlet. Development is by tunnels, showing ore carrying c per, nickel and cobalt. Idle at last accouts, but resumption planned o considerable scale.

BEAVER VALLEY COPPER CO. IDA

Black Bird Copper-Gold Co. intended taking this title in 1903.

ECKLER RIVER GROUP. WASHINGTO

Sold, circa 1904, to Apex Mining Co.

BEDE METAL & CHEMICAL CO., LTD. SPAIN & NORWA

Offices: Hebburn-on-Tyne, Eng. General Spanish offices: Manriques, Córdoba, Spain. Sir Andrew Noble, K. C. B., F. R. S., chairman; W. Brown, secretary; Richard E. Carr, general mine manager; C. E. Tu engineer. Organized 1871, with capitalization, £115,360, shares £10 p Dividends for 1901 and 1902 were 5% each year. Is primarily a manufactu of acids and chemical products, but secures a considerable amount of copp from the cinders of Spanish and Norwegian cupriferous pyrites. Princi mining property, area 136 hectareas is Las Herrerias mine, at Puebla de G mán, Huelva, Spain, held under lease from C. & J. Sundheim, this including mines, in two groups, and employing several hundred men. The main o body is a large, irregular, mass of solid cupriferous iron pyrites, in schis carrying average values of 1.5% copper and 47% sulphur. Main shaft is 2 the principal workings being open-cast, with two mineral floors, each about meters in height. Has steam power and one locomotive. Ore, as mined, placed in level-top piles, 6 to 8 meters high, in open air, and these a sprinkled systematically, the leach-water, carrying 2% to 2.5% copper, be drawn off through long, narrow channels, containing pig iron, and the resul ing precipitate, averaging 70% to 80% copper, dried and shipped to the com pany's works in England for refining.

The Killingdal Kobbervaerk, in Norway, also is operated by the Bede Com pany. Product is cupriferous iron pyrites carrying an average of about 2.5% copper. Production, 1904, was 1,128,960 lbs. fine copper from Spain a 654,080 lbs. from Norway, a total of 1,783,040 lbs.

BELCHER MINING CO. WASHINGTO

Mine office: Republic, Ferry Co., Wash. J. L. Harper, general manager. Mine is opened by three tunnels, of which No. 3, the 1,000′ main tunnel, shows a large body of medium-grade ore carrying a 2′ footwall paystreak of very high-grade chalcopyrite. Is building a 1,000′ aerial tramway, to connect the main adits with railroad bins. Water, brought 2,000′ from Lambert Creek, through a steel, pipe, generates electric power, and gasoline power is used also. Has 8 power drills. Property considered promising.

BELEN MINING CO. MEXICO

Office: 12 Chamber of Commerce, Minneapolis, Minn. Mine office: Cumpas, Sonora, Mex. Chas. E. Wenzel, president; John E. Stair, vice-president; Ace P. Abell, secretary and treasurer; T. B. Bassett, general manager. Or

ganized circa May 20, 1901, under laws of South Dakota, with capitalization $1,200,000, shares $10 par. Lands, 217 acres mineral holdings, and circa 14,000 acres ranch and lumber lands. Active mining was begun in spring of 1905. Has 7 shafts and tunnels, showing a mineral ledge of 280′ to 350′ width, traceable about 7,500′. Assays have given values of $36 to $225 per ton, latter from a 30″ vein in shaft No. 2. Has a steam and electric power plant running 2 electric hoists, electric drills and lighting mine and camp buildings. Wood is used for fuel. Company plans building a concentrator, tests having shown concentration of 3 into 1, with a value of about $25 for concentrates from low grade ore, of which a large amount is available. Nearest railroad point is Nacozari. Mine has shipped some ore to the copper Queen smelter, at Douglas, but plans shipping 75 to 100 tons daily to the nearby smelter of the Transvaal Copper Co., which went into blast May 1, 1906. About 100 men are employed. Company seems well managed, and property is considered promising.

BELENE COPPER CO. **MEXICO.**

Office: 515 Bryan Bldg., Los Angeles, Cal. Mine office: El Copete, Sonora, Mex. J. J. Hardwick, president and general manager; Harry R. Hay, secretary and treasurer; Luis Killeen, assistant manager. Organized 1901, under laws of Arizona, with capitalization $5,000,000, shares $5 par; registered and protocolized in Mexico, June 25, 1902. Lands, 405 acres, in the Ures district, showing two large sulphide ore lenses, said to give average assays of 12% copper, 8 oz. silver and $10 gold per ton. Has 9 shafts, of 65′ to 310′ depth, and 3 tunnels, of 40′ to 200′ length, with about 1,500′ of underground openings. Plans to install steam and electric power and to build a smelter when nature of ores below water-line is developed. Smelter of Copete Mining Co is on lands of the Belene. Idle since circa 1903.

COMPAGNIE DE CUIVRE DE BELGIQUE. **BELGIUM.**

Office and works: 17, Quay Napoleon, Antwerp, Belgium. Employs 60 men. Marquis de Seine, chairman; Louis J. Burkard, commercial director; H. de Montagu, metallurgical director; Herman G. C. Thöfehrn, consulting engineer. Organized April, 1905, under laws of Belgium, with capitalization 500,000 francs, shares 500 f. par. A smelter, at Duffel, a suburb of Antwerp, and connected therewith by water, has a 250-ton blast furnace and five 100-ton reverberatory furnaces.

SOCIÉTÉ ANONYME BELGE POUR LA RECHERCHE ET L'EXPLORATION DES MINERAIS. **ITALY.**

Mine office: Massa Marittima, Grosseto, Italy. A Belgian company, operting a mine of slightly cupriferous iron pyrites.

BELL MINE. **MEXICO.**

Office: care of Robert Tate, manager, Bisbee, Ariz. Lands, sundry claims, circa 18 miles west of Fronteras, Sonora, Mexico, showing rich auriferous and argentiferous copper ores. Company planned making a small smelter shipment early in 1906.

BELL MINE. **MONTANA.**

Owned and operated by Anaconda Copper Mining Co.

Lands, 1,300 acres, in the Blue Ridge Mountains, carrying two veins, apparently averaging about 50′ width and prospected for about 1,500′ in length. Upper vein carries mainly disseminated chalcopyrite; lower vein mainly pyrrhotite, with prospect that these veins join at depth. Has 4 short tunnels, 2 shallow shafts and 20 drill-holes, with indications favoring possession of a large amount of low to medium grade ore. Assays average about 4.5% copper and $1.60 gold per ton from chalcopyrite, the pyrrhotite showing nickel and traces of platinum. Owners are said to plan development upon a considerable scale.

BEULAH COPPER CO. — **WYOMING.**

Dead. Supposedly absorbed by United Exploration Co.

BIG BONANZA MINE. — **ALASKA.**

On Latouche Island, about 60 miles from Valdez. Was said, October, 1904, to have been bonded for $750,000, to F. August Heinze, with proviso that $50,000 be expended immediately on development work.

BIG BUG GOLD & COPPER MINING CO. — **ARIZONA.**

Office: Byrne Bldg., Los Angeles, Cal. Mine office: care of Thos. C. Job, Prescott, Yavapai Co., Ariz. J. H. Canovan, president and general manager. Lands, 62 acres, in the Big Bug district of Yavapai county. Presumably idle.

BIG COLORADO MINING & MILLING CO. — **COLORADO.**

Mine office: Gladstone, San Juan Co., Colo. C. W. Bloodgood, manager, at last accounts. Ores carry gold, silver, copper and lead. Has electric and gasoline power. Presumably idle.

BIG COPPER CLAIM. — **BRITISH COLUMBIA.**

Office: care of Geo. B. McAulay, owner, Spokane, Wash. Mine office: Greenwood, Yale district B. C. Lands, at Copper Camp, 6 miles from Greenwood, are said to show a large amount of ore, of good grade.

BIG COTTONWOOD COPPER & GOLD MINING CO. — **UTAH.**

Office: 305 Auerbach Bldg., Salt Lake City, Utah. Mine office: Brighton, Salt Lake Co., Utah. Col. Nicholas Treweek, president and general manager; Joseph G. Fariss, secretary. Capitalization $1,500,000, shares $5 par. Has a 500′ tunnel, showing ore bodies assaying 4% to 10% copper and up to $3 per ton gold and silver. Installation of an electric plant is under consideration. Management is good, and property is regarded as above the average in promise.

BIG CREEK COPPER CO. — **WYOMING.**

Dead. Formerly had its habitat at Encampment, Carbon Co., Wyo.

BIG HORN MINING CO. — **COLORADO.**

Mine office: Pearl, Larimer Co., Colo. Has a 50′ shaft, on the Copper Queer group, bottomed in a 5′ vein claimed to assay 20% copper. Presumably idle.

BIG INDEX GOLD & COPPER MINING CO. — **WASHINGTON.**

Office: 419 Pioneer Bldg., Seattle Wash. Mine office: Index, Snohomish Co., Wash. Wm. Frankfurt, president; J. C. Rathbun, secretary; Ed. E. Aegerter, superintendent. Organized 1902, under laws of Washington, with capitalization $2,500,000, shares $1 par. Lands, 15 claims, area 300 acres, 4 miles from a railroad, in the Washington district, opened by a 350′ tunnel, showing ores giving average assay values of $26 per ton, in copper and gold, principally latter. Presumably idle.

BIG INTERIOR MINE. **BRITISH COLUMBIA.**

Mine office: Alberni, Vancouver Isld., B. C. Property is sundry claims in the interior of the island, 5,000′ above sea-level, slightly developed and showing a strong outcrop of low-grade ore for nearly one mile.

BIG LEAD MINING & SMELTING CO. **ARIZONA.**

Office: Philadelphia, Pa. Mine office: Kelvin, Pinal Co., Ariz. Edwin L. Taylor, president; Wm. B Twitchell, general manager. Lands, sundry claims adjoining the Ray mines, 5 miles from Kelvin, opened by shaft, said to show oxide and carbonate ores averaging 3.5% copper, with small gold and silver values. Sulphides are expected at depth. Completed a leaching plant in February, 1906, and is said to have leased the Bobtail mill and to have ordered a 100-ton concentrator.

BIG SHOW SILVER & COPPER MINING CO. **MONTANA.**

Mine office: Twin Bridges, Madison Co., Mont. Organized under laws of Arizona, with capitalization $1,500,000, shares $1 par. Lands, 4 claims, showing auriferous and argentiferous copper ores.

BIG YANK MINING & MILLING CO. **OREGON.**

Office: 414 Abington Bldg., Portland, Ore. Mine office: Galice, Josephine Co., Ore. J. C Mattison, superintendent, at last accounts. Has auriferous and argentiferous copper ores.

BIGELOW GOLD & COPPER MINING CO. **NEW MEXICO.**

Letter returned unclaimed from former office, 49 Exchange Place, New York. Mine office: Hillsboro, Sierra Co., N. M. Wm. Buchanan, president and treasurer; J. H. Bigelow, secretary. Organized 1903.

BILBAINAS GROUP. **SPAIN.**

Office: care of Aznar y Ca., owners, Bilbao, Spain. Mine office: Paimogo, Huelva, Spain, Property is the eastward extension of La Romanera group, and is considered promising.

BILLION DOLLAR QUEEN MINING CO.

A stock-jobbing scheme, promoted by a petticoat grafter called Mrs. Van Arsdale, née Estella Trunnell, alias Mrs. Estella True-Nell.

BI-METALLIC GOLD & COPPER MINING CO. **WASHINGTON.**

Said to have claims somewhere in Okanogan county, Washington, opened by tunnel.

BINGHAM CENTENNIAL MINING CO. **UTAH.**

Succeeded, Feb. 11, 1904, by South Columbus Mining Co.

BINGHAM CENTRAL MINING CO. **UTAH.**

Mine office: Bingham Canyon, Salt Lake Co., Utah. Samuel Newhouse, president; Daniel C. Jackling, vice-president and general manager; Chas. W. Whitley, treasurer; Wm. M. Bradley, secretary; preceding officers, Edward B. Critchlow and Frederick A. Schirmer, directors. Organized under laws of Utah, with capitalization $2,000,000, shares $5 par. Lands, sundry claims, including the Davies and Gebhardt properties, lying between the Utah Consolidated and Boston Consolidated mines, in Bingham Canyon. Development is by 2 tunnels, the upper, known as the Whitley, and the lower as the Jeff Davis, latter cutting ore at 680′. Company is said to plan a bond issue, followed by

development on a considerable scale. Management is good and property is considered valuable.

BINGHAM-COCHISE COPPER MINING CO. **UTAH.**

Mine office: Bingham Canyon, Salt Lake Co., Utah. Organized January, 1906, under laws of Utah, with capitalization $500,000, shares $1 par. Lands include the Cochise and Brooks claims, in the Bingham district.

BINGHAM CONSOLIDATED MINING & SMELTING CO. **UTAH.**

Offices: 60 State St., Boston, Mass., and 700 McCornick Bldg., Salt Lake City, Utah. Mine office: Bingham Canyon, Salt Lake Co., Utah. Smelter office: Murray, Salt Lake Co., Utah. Edward L. White, president; W. S. McCornick, vice-president; W. J. Freeman, secretary: O. E. Weller, treasurer: preceding officers, J. M. Weeks, H. N. Sweet, J. A. Coram, Wm. Bayly, Geo. A. Baird, W. F. Hammett and L. T. Trull, directors; Duncan McVichie, general manager; B. W. Rogers, mine superintendent; W. H. Nutting, smelter superintendent; H. G. Heffron, purchasing agent and ore buyer. Organized April 5, 1901, under laws of Maine, as a reorganization of the Bingham Copper and Gold Mining Co., with capitalization $10,000,000, shares $50 par, non-assessable and fully paid. Bonds, $1,000,000 authorized, at 6%. Annual meeting, third Wednesday in April.

Lands, circa, 300 acres, in the Bingham or West Mountain district, including the Dalton & Lark, Antelope, Brooklyn, Commercial, Miner's Dream, Sampson, Old Hickory, Vernard, Bingham and sundry other mines and claims. Company also owns an interest of 231,500 shares in the Tesora mine, of the Tintic district, and about 190,000 shares out of 250,000 in the Eagle & Bluebell Mining Co. The Bingham properties have a considerable variety of ores, principally sulphides, with gold and silver-lead values at and near surface, changing to auriferous and argentiferous chalcopyrite at depth, later averaging 2.5% to 3% copper, with gold and silver values of about $2 per ton. Some of the ore is rich in iron, hence desirable for fluxing, as most of the ores of the district are highly silicious and deficient in iron.

The Dalton & Lark mine has shafts of 850′ and 1,150′, the bottom level showing ore carrying 7% copper and 60 oz. silver. There also are 4 tunnels, one with an electric haulage plant. The Mascot tunnel, 7,000′ long, drains the Dalton & Lark, Brooklyn and Miner's Dream mines. This tunnel, planned both for drainage and mining, should effect a saving of perhaps $1 per ton in pumping and extraction costs. The Dalton & Lark ores average $10.71 per ton in recoverable values, and the mine has about 250,000 tons of high-grade and 500,000 tons of low-grade ore in sight. All ore is handled by gravity, giving cheap working costs.

The Commercial mine has shown decided improvement since 1904, and at end of 1905 showed reserves of 500,000 to 1,000,000 tons of low and medium grade ore. These include considerable argentiferous galena, also low-grade auriferous and and argentiferous copper ores carrying values of $4 to $5 per ton, with excess of iron, and mainly valuable for fluxing.

The Brooklyn mine, 1,600′ deep, shows a vein of 20′ to 25′ width in the bottom levels, exposing a large tonnage of low and medium grade ore.

The Miner's Dream mine has been drained by the Mascot tunnel, and will be operated through that tunnel, which taps the ore bodies 600′ lower than the bottom of the old workings.

The Sampson mine carries auriferous galena and auriferous and argentiferous chalcopyrite.

The Tesora, in the Tintic district, does not seem to have proven an especially valuable acquisition.

The mine of the Fortune Mining and Milling Co., at Bingham, is held under lease, and is a producer.

The Eagle & Blue Bell property is described separately, under name of company holding direct title.

The smelter, at Murray, 13 miles from the mine, was blown in January 31, 1901. The building is 150x400′ in size, with steel frame on stone foundations, steel and cement floors and iron sides and roof, the only wood in the structure being the ore-bin partitions. Plant is terraced, allowing the handling of material by gravity. There are five 200-ton 42x172″ water-jacket blast-furnaces and one large reverbratory furnace has been added, going into blast November, 1905. A new battery of calcining furnaces is being installed, and a briquetting plant has been built to handle fines. With these additions the smelter will have a daily capacity of fully 1,000 tons. The smelter has both steam and electric power, with a 1,000-h. p. Rarig blowing-engine, Stirling water-tube boilers and automatic stokers. The pyritic smelting system is used, ores being smelted to low-grade matte, and resmelted with silicious sulphides, producing a matte of 30% to 35% in tenor, which is blown up to blister copper averaging 98.35% in tenor and carrying average gold and silver values somewhat greater than the value of the copper itself. Adjoining the smelter building is a 375′ dust chamber, with a 200′ steel smokestack 12′ in diameter. The conversion plant has 2 stands, with six 10-ton shells, 84x126″.

The Bingham management planned building a lead stack and invading the general smelting field, but was persuaded by the American Smelting & Refining Co. to keep off the preserves of the latter, and was given profitable contracts to smelt the concentrates of the Utah Copper Co. and the Newhouse Mines & Smelters Corporation. The Bingham practically is in control of the custom copper smelting business of Utah, but soon is to have serious competition from the new Garfield plant of the American Smelting & Refining Co. The Bingham company is endeavoring, apparently with success, to put itself in a position to dispense with the custom business, and keep its plant busy on the ores of its own mines.

For 1905 the Bingham's production was 14,396,269 lbs. fine copper, 1,244,246 oz. silver and 29,153 oz. gold. The company is in a strong position as to mines and smelter, and should be able soon to gladden shareholders with the long-deferred dividends.

BINGHAM COPPER BOY MINING CO. **UTAH.**

Office: 14 West First South St., Salt Lake City, Utah. Mine office: Bingham Canyon, Salt Lake Co., Utah. Abram Hanauer, Jr., president; J. H. Hurd, secretary; W. A. Cooke, treasurer and general manager J. B.

Taylor, superintendent. Organized February 19, 1901, under laws of Utah, with capitalization $1,500,000, shares $1 par. Annual meeting, first Monday in March. Lands, 12 claims, 11 patented, area 153 acres, also a 10-acre mill-site, in the West Mountain and Tooele districts, adjoining the Highland Boy mine of the Utah Consolidated, on the west. Property shows 3 veins of 20′ to 40′ width, giving average assays of 6% copper, 20% lead, 1.5% zinc 18 oz. silver and $2.50 gold per ton. Ore on the dump shows 2% to 4.5% copper. Development is by an 800′ crosscut tunnel and a lower tunnel of 2,000′, with about 6,500′ of underground openings, estimated by the company to put 1,500,000 tons of ore in sight. Company plans adding steam power and air-compressor, building a 300-ton concentrator, and installing electric power, during 1906. Underground development will be continued. Management is considered good and property regarded as promising.

BINGHAM COPPER & GOLD MINING CO. **UTAH.**

Offices: 60 State St. Boston. Mass., and 700 McCornick Bldg., Salt Lake City, Utah. Is the parent corporation of the Bingham Consolidated Mining & Smelting Co., and presumably is kept alive for corporate purposes, as Twentieth Century corporation lawyers have discovered that a corporation never should be buried, no matter how dead it may become.

BINGHAM COPPER-GOLD MINING CO. **UTAH.**

Mine office: Silver City, Juab Co., Utah. James Creighton, superintendent, at last accounts. Ores carry gold, silver and copper. Has steam power and a 100-ton concentrator.

BINGHAM-COPPER HILL MINING CO. **UTAH.**

Office: care of Abram Hanauer, Jr., secretary, Salt Lake City, Utah. Henry P. Clark, president; Wm. M. Bradley, vice-president. Organized Dec. 20, 1905, under laws of Utah, with capitalization $1,500,000, shares $5 par. Lands, 5 patented claims, known as the Copper Hill group, adjoining the Congor. Considerable gophering has been done in the past, by shafts and tunnels. A 500′ tunnel is to be extended circa 325′, to tap anticipated ore bodies.

BINGHAM COPPER MINING CO. **UTAH.**

Letter returned unclaimed from former mine office, Bingham Canyon, Salt Lake Co., Utah. Organized 1905, Lands include the Mary and Commonwealth claims.

BINGHAM & EASTERN COPPER MINING CO **UTAH.**

Reorganized, 1903, as Bingham & Eastern Mines Co.

BINGHAM & EASTERN MINES CO. **UTAH.**

Presumably dead. All letters returned. Described in Vols. IV and V.

BINGHAM GROUP MINING CO. **UTAH.**

Mine office: Bingham Canyon, Salt Lake Co., Utah. Albert Booth, manager. Said to plan repairing the 3,000′ Last Chance tunnel, preparatory to working the Greeley-Sacred claims.

BINGHAM MARY MINING CO. **UTAH.**

Mine office: Bingham Canyon, Salt Lake Co., Utah.

BINGHAM METAL MINING CO. **UTAH.**

Office: care of Clarence K. McCornick, president, Salt Lake City, Utah. Mine office: Tooele, Tooele Co., Utah. H. L. J. Warren, general manager. Lands, sundry claims, area 500 acres, in the Bingham field, 3 miles southwest of the Utah Copper Co., extending over the divide into Tooele county. It is thought that the cupriferous porphyries of Bingham Canyon extend to this company's properties, and it is planned to develop same through a tunnel, to be started in Middle Canyon, on the Tooele side.

BINGHAM-NEW HAVEN COPPER & GOLD MINING CO. **UTAH.**

Office: P. O. Box 84, New Haven, Conn. Mine office: Bingham Canyon, Salt Lake Co., Utah. Employs about fifty men. Louis E. Stoddard, president; N. M. Bradley, vice-president; Thos. W. Farnam, secretary and treasurer; Frank A. Taylor, general manager; Geo. H. Robinson, consulting engineer; C. H. Doolittle, superintendent. Organized October, 1902, under laws of Utah, with capitalization $2,000 000, shares $5 par. Bonds, $200,000 authorized, $78,250 issued, at 6%. Lands, 26 claims, area 500 acres, including the Zelnora mine, near the head of Carr Fork, adjoining the Highland Boy mine of the Utah Consolidated. Property shows three veins, occurring as fissures in porphyry and as a contact vein between porphyry and limestone. Main vein, 3′ to 8′ wide, between limestone and quartzite, carries 2% to 6% copper, 10% to 22% lead, 7% to 12% zinc, 2 oz. to 8 oz. silver and 40 cents to 80 cents gold per ton. Ores are chalcopyrite, galena and sphalerite. Mine has about 13,000′ of underground openings, and has a tramway connecting with loading-bins on the Copper Belt railroad. Is equipped with electric power and air-compressor. Is shipping about 50 tons of ore daily to the Murray works of the American Smelting & Refining Co. Property seems well handled, and is considered valuable.

BINGHAM & SALT LAKE MINING CO. **UTAH.**

Letter returned unclaimed from former office, Salt Lake City, Utah.

BINGHAM WEST DIP TUNNEL CO. **UTAH.**

Office: Salt Lake City, Utah. Mine office: Tooele, Tooele Co., Utah. F. M. Lyman, president; Milando Pratt, secretary; F. M. Bishop, treasurer. Capitalization $100,000, shares one cent par. Lands, circa 520 acres, unpatented, opened by an 850′ tunnel, planned to be driven 4 miles, from the Tooele side, through the Oquirrh range, to drain the entire West Mountain district, develop mineral bodies and provide water for the Tooele lands. Tunnel has cut several small ore bodies. Company said to be out of debt.

BIRTHDAY COPPER SYNDICATE. **TASMANIA.**

Lands, 510 acres, giving a fair showing of copper ore, near the coast and about 20 miles from Macquarie Heads, Tasmania.

BISBEE-ARIZONA DEVELOPMENT CO. **ARIZONA.**

Office and mine: Postoffice Bldg., Bisbee, Cochise Co., Ariz. M. R. Harlan, general manager. Lands, 14 claims, area 280 acres, in the Warren district, near the Modern mine, about 7 miles northwest of Bisbee, said by company to show 7 contact veins between limestone and porphyry, of which 2 veins, averaging 6′ width, are claimed by company to give average assays of

claims, area, 1,165 acres, and 23 claims held by location, adjoining the Cactus mine of the Newhouse company, on which a large shaft has been started. Considerable development has been secured and the property is regarded as promising, especially the Utah holdings, on which nothing but the compulsory assessment work has been done since 1903. Company reports an actual cash investment of $607,353.08 to Jan. 1, 1905.

BLACK BUTTE MINING & REDUCTION CO. **ARIZONA.**

Office: Phœnix, Ariz. Mine office: Castle Creek Hot Springs, Yavapai Co., Ariz. T. Connell, president and treasurer; M. Thompson, secretary; J. C. Dobbins, general manager. Organized under laws of Arizona, with capitalization $750,000, shares $1 par; issued, $350,000. Lands, 5 claims, area 102 acres, held by location, in the Castle Creek district, 26 miles from Santa Fé, Prescott & Phœnix railway, showing fissure veins in shales, 3 veins averaging 8′ width carrying cuprite, azurite, malachite, chalcocite and atacamite, opened by a 220′ tunnel and 170′ shaft. Has steam power and necessary mine buildings. Development as yet is within the leached zone, atacamite being the predominant ore, this occuring in a pay-streak of 12″ to 18″ along the footwall and giving average assays of 34% copper. Idle.

BLACK CANYON COPPER CO., LTD. **ARIZONA.**

Dead. Was a bad outfit. Lands have gone to Canyon Mining Co.

BLACK CHIEF MINE. **ARIZONA.**

Letter returned unclaimed from former mine office, Dewey, Ariz.

BLACK COPPER CO. **NEW MEXICO.**

Mine office: Elizabethtown, Colfax Co., N. M. A gold producer only.

BLACK DIAMOND COPPER MINING CO. **ARIZONA.**

Office: care of E. D. Kennedy, treasurer and general manager, Warren, Ohio. Mine office: Pearce, Cochise Co., Ariz. J. G. Hearne, president; H. C. Christie, vice-president; Dr. T. M. Sabin, secretary; W. G. Barney, superintendent. Organized 1898, under laws of West Virginia, with capitalization $2,000,000, shares $5 par. Sold $480,000 bonds, at 50 cents on the dollar. Lands, 35 claims, area circa 500 acres, 6 miles from Pearce, in the Cochise Mountains. Ores occur as contact veins between limestone and porphyry, with parallel dykes of sandstone and quartzite, having a heavy gossan capping, in places 150′ wide. Ores are almost exclusively sulphide, being mainly chalcopyrite and bornite, with iron and silica gangue, estimated to average better than 6% copper, 10 oz. silver and $1.40 gold per ton, with about 38% silica. Property was opened originally for silver. Development is by 4 tunnels, lowest 600′ below crest of the hill, tunnels being connected by winzes. Mine is connected with smelter by a 1½-mile Leschen aerial tramway, having a drop of 800′, with 600 tons daily capacity. Has a pumping plant with 4″ pipeline, installed at Pearce, this having capacity to raise 100,000 gallons daily against a head of 804′ in 6 miles, with a 350,000-gallon storage reservoir at the mine. Property has a good steam equipment, including two air-compressors with 15-drill capacity, petroleum being used for fuel. Miscellaneous improvements include a 20-room hotel, store, schoolhouse and a considerable number of dwellings. A 200-ton smelter, built 1902, has a 44x120″ Allis-Chal-

mers rectangular water-jacket blast-furnace, a 38" auxiliary cupola and a 24x36' circular roaster, and made a matte carrying about 65% copper, and 150 oz. to 300 oz. silver per ton, with small gold values. Ores are self-fluxing, and easily smelted, and furnace is claimed to have shown slag losses of only 0.3% copper. Company came to grief financially, and was practically reorganized and management changed. Work was resumed in fall of 1905, and 25 men were employed at close of year, when it was planned to resume smelting early in 1906.

BLACK DIAMOND MINING & DEVELOPMENT CO. **WYOMING.**

Office: care of Perry F. Powers, Cadillac, Mich. Presumably idle.

BLACK DIAMOND TUNNEL CO. **BRITISH COLUMBIA.**

Office: 604 Land Title Bldg., Philadelphia, Pa. Mine office: Ainsworth, Kootenay district, B. C. Maxwell Stevenson, president; Henry M. Stevenson, secretary. The Highlander tunnel, having a total length of about 3,000', has cut three veins of 4' to 13' width, giving fair assays in silver, lead, copper and gold. Although the officers of the company were claimed to stand well locally, the company was a mere stock-jobbing scheme. Idle for several years and apparently moribund.

BLACKFOOT COPPER CO. **MONTANA.**

Succeeded, 1901, by Imperial Montana C. M., S. & W. P. Co.

BLACKFOOT MINING & MILLING CO. **WYOMING.**

Property supposed to be in vicinity of Battle, Carbon county, Wyoming.

BLACK FOREST GROUP. **NEVADA.**

Office and mine: care of C. M. Spence, owner and manager, Wells, Elko Co., Nevada. Ores carry copper, gold, silver and lead. Has water power and a small smelter. Presumably idle.

BLACK HAWK MINE. **ARIZONA.**

Mine office: Globe, Gila Co., Ariz. Lands, sundry claims near Globe, claimed to show a vein 40' wide at surface, averaging 9% copper and 2 oz. to 8 oz. silver per ton, which, of course, is a great exaggeration.

BLACK HILLS COPPER CO. **SOUTH DAKOTA.**

Office: Benton Harbor, Mich. Mine office: Rochford, Pennington Co., S. D. John E. Barnes, president; George M. Thresher, secretary; John Robinson, treasurer. Organized June 2, 1900, under laws of South Dakota, with capitalization, $2,000,000, shares $1 par. Lands, 27 claims, area 510 acres, in the Hornblende district, showing fissure veins in slate, with heavy gossan capping, carrying carbonate and oxide ores. The ore body under development is said by company to average 20' width, and to be more than a mile in length, opened by incline shafts of 800', 40' and 75', with crosscut tunnels of 65' and 300', giving a total of about 1,200' of underground openings. Ores average 1.5 to 3% copper, with small values in gold, silver and nickel, and a carload shipment of carbonate ore gave smelter returns of 16.31% copper. Has steam power, with 60-h. p. hoist, good for 1,500', and 4 power drills. Presumably idle.

BLACK HILLS COPPER CO., LTD. **ARIZONA.**

Office: 232 Fifth Ave., Pittsburg, Pa. Mine office: Jerome, Yavapai

Co., Ariz. Employs 16 men. R. A. Thomas, president; Peter Boyd, vice-president; F. J. LeMoyne, secretary and treasurer; Ed. Beven, superintendent. Organized July, 1899, and reorganized May 20, 1901, under laws of Arizona, with capitalization $3,000,000, shares $1 par. Union Trust Co., Pittsburg, registrar; Colonial Trust Co., Pittsburg, transfer agent.

Lands, 15 claims, 6 patented, area 280 acres, in the Verde district, opened by shafts of 212′ and 550′, with tunnels of 60′ and 90′, with about one-half mile of openings. Main shaft, at 382′, cut a stringer of ore assaying up to 13% copper and 3 oz. silver. Has a 280-h. p. steam plant, with 125-h. p. tubular high-pressure boiler, duplex pump, hoist and power drills. Old management kept property free of debt. New blood was secured, and work resumed August 20, 1905. It is planned to sink the main shaft to depth of 1,000′, then crosscut and drift from that level, which is an eminently business-like program. Property lies between the United Verde and Equator mines, and is well regarded.

BLACK HILLS COPPER MINING CO.

Office: 310-73 Tremont St., Boston, Mass.

BLACK HILLS & DULUTH COPPER MINING CO. **SOUTH DAKOTA.**

Mine office: Custer, Pennington Co., S. D. F. A. Towner, president; M. J. Bailey, secretary; W. F. Hanley, treasurer; W. A. Nelson, superintendent. Capitalization, $3,000,000, shares $1 par. Lands, 340 acres, 8 miles northwest of Custer, adjoining the Central Black Hills Coppper Co., showing promising outcrops of argentiferous and auriferous copper ores, which have given assays up to 20% copper, slightly developed by 2 shafts. Has water power. Idle.

BLACK HILLS GOLD & COPPER MINING CO. **ARIZONA.**

Office: care of R. H. Burmister, general manager, Prescott, Yavapai Co., Arizona. Property is in the Black Hills of Yavapai county. Idle.

BLACK JACK MINE. **UTAH.**

Office: care of Jesse Knight, owner, Provo, Utah. Letter returned unclaimed from former mine office, Park City, Summit Co., Utah. Mine has considerable development, showing horn silver and copper ore up to 6% in tenor.

BLACK MARIA & SILVER BELLE MINES. **IDAHO.**

Mine office: Mineral, Washington Co., Idaho. Mine is opened by tunnel and shaft. Ores carry copper and silver. Has steam power and a 20-ton smelter. Presumably idle.

BLACK MOUNTAIN MINING CO. **MEXICO.**

Office: 135 Adams St., Chicago, Ills. Mine office: Magdalena, Sonora Mex. Wm. Z. Stuart, president and treasurer; F. S. Sensenbrenner, secretary; N. C. Banks, general manager; Phillip N. Moore, consulting engineer. Organized 1904, with capitalization $2,000,000, shares $5 par, as a reorganization of the Nogales Copper Co.

Lands include sundry copper claims in the Patagonia and Pajorita districts of Santa Cruz county, Arizona, described in Volume IV, but these will be allowed to remain idle for the present. Principal property is the Carr-

Prieto gold mine, 26 miles southeast of Magdalena, and connected therewith by a good wagon road. Lands carry about 3 miles of the Cerro Prieto vein, outcropping 7′ to 100′ in width. The ore body is a low grade auriferous quartz-porphyry, giving assays of $4 to $12 gold per ton. The old mill on the property is said to have secured net returns of $7 per ton. Mine is opened by tunnels, permitting cheap extraction. No. 8, the principal tunnel, is 1,700′ long, with double tram-tracks and electric haulage plant, equipped with 4-ton cars, planned to handle 500 tons per 8-hour shift. Vein ranges 7′ to 30′ wide in this tunnel.

Power is generated at Magdalena and transmitted 26 miles to the mine. Reason for this long transmission is found in the hilly country, and the advantage of locating the power-plant on the railroad line. The Magdalena plant has an 8-acre site, adjoining the Southern Pacific railway. Equipment includes Westinghouse turbine engines, and the foundation is built for a plant of double the present size. There also is a 40x100′ brick warehouse at Magdalena. Improvements at the mine include a 40x140′ general store, 30x100′ warehouse, 18-room hotel and 47 dwellings for workmen.

The first unit of the stamp mill at the mine was completed May, 1906, this has 120 stamps, operated throughout by electricity, and housed in a steel structure with cement foundations. It is, without doubt, the most modern gold mill in the world, and it is planned to ultimately increase its capacity to 480 stamps. Water is secured from a 40′ well on the San Domingo river, and is forced by electric pumps through 15,000′ of 8″ pipe to the mill.

Some litgation, begun against the company early in 1906, seems to be founded on insufficient grounds. It was expected that the plant would go into operation about June, 1906. Management is good and property is considered very promising.

BLACK PEAK GOLD & COPPER MINING CO. **NEW MEXICO.**

Lands, 6 claims, in Sierra county, New Mexico, with about 2,000′ of development work, claimed to show about 5,000 tons of shipping ore. Idle at last accounts.

BLACK PRINCE COPPER CO. **ARIZONA.**

Office: 506 Exchange Bldg., Denver, Colo. Mine office: Johnson, Cochise Co., Ariz. Benj. F. Woodward, president; Alex. Ross, treasurer; Thos. O. Ford, secretary; Robert McCabe, superintendent. Lands, 8 claims, 7 patented, area 167 acres, developed by several old incline shafts and a new 2-compartment shaft, circa 75′ at close of 1905. Has shipped more or less ore, of good average grade, secured from development work.

BLACK RANGE COPPER MINING CO. **NEW MEXICO.**

Office and mine: Fairview, Sierra Co., N. M. Organized January, 1906, with capitalization $1,250,000, shares $1 par, by B. S. Phillips, et al.

BLACK ROCK COPPER CO. **H.**

Has lands in the Beaver Lake district of Beaver county, Utah, on which work has been in progress since 1904, showing ore assaying up to 36% copper with small gold and silver values.

BLACK ROCK GOLD & COPPER MINING CO. **ARIZONA.**

Office: Kankakee, Ills. Wm. D. Powell, president; Frederick S. Breen, secretary and treasurer; M. W. Breen, fiscal manager. Organized under laws of Arizona, with capitalization $1,000,000, shares $1 par. Lands, 20 claims, area 400 acres, in 2 groups, in Yavapai county, Arizona, one of these claims lying about four miles from the United Verde and the other lying about 20 miles south of the United Verde. Upper group is opened by a 150′ two-compartment shaft, said to show a vein of 4′ to 8′ width, lower group has shafts of 60′ and 75′. Assays of ore are said to run from $15 to $80 per ton. Officers are men of good standing, but company's prospectus contains a number of misleading statements. Presumably idle.

BLACK ROCK MINING CO. **ARIZONA.**

Office: care of R. C. Vincent, president and manager, Superior, Wis. Mine office: Wickenburg, Maricopa Co., Ariz. Lands, 9 claims, area 180 acres, in the Bradshaw Mountains, 17 miles from rail connection at Wickenburg. Country rocks are granite and syenite, showing 4 fissure veins, averaging about 30″ width, carrying copper, lead, gold and silver, with quartz gangue, and also showing porphyritic dykes carrying low-grade ores. Development is by several shallow shafts and short tunnels. Has gasoline power. Fred H. Perkins, former superintendent, is accused by management of having misappropriated company's funds. Idle.

BLACK ROCK MINING CO. **MONTANA.**

Office and mine: Butte, Silver Bow Co., Mont. Property is the Black Rock mine, in the eastern part of Butte, held under 3 to 5 years' lease. Main shaft, 400′.

BLACK TIGER COPPER MINING CO. **WYOMING.**

Dead. Property lost.

BLACK TIGER MINE. **COLORADO.**

Mine office: Red Cliff, Eagle Co., Colo. J. F. Fleming, superintendent. Has ores carrying gold, silver and copper, opened by tunnel.

BLACK WARRIOR COPPER COMPANY, AMALGAMATED. **ARIZONA.**

Reorganized, 1905 as Warrior Copper Company.

BLACK WARRIOR GROUP. **BRITISH COLUMBIA.**

Letter returned unclaimed from former mine office, Alberni, Vancouver Island, B. C. Owned by A. Watson, et al. Is slightly developed by tunnel and open cuts, giving ore assaying 15% copper, $3 silver and $2 to $12 gold per ton. Idle for several years.

BLANCHE COPPER MINING CO. **WYOMING.**

Office: 432 Omaha National Bank Bldg., Omaha, Neb. Mine office: Encampment, Carbon Co., Wyo. H. E. Owen, president; Jas. H. Kyner, secretary; Arthur H. Crow, general manager. Organized April 2, 1902, under laws of Wyoming, with capitalization $1,000,000, shares $1 par. Lands, 5 claims, near the New Rambler, on which a slight amount of development work is claimed to show two veins, one of which, 3′ to 5′ wide, is claimed to show auriferous oxide, carbonate and sulphide ores. Has steam power. Idle at last accounts.

BLANCHE MINE. **NEW MEXICO.**

Office and mine: Organ, Donna Ana Co., N. M. Idle.

BLAND MINE. **ARIZONA.**

Mine office: Patagonia, Santa Cruz Co., Ariz. Powers, Clark & Heck, owners. Has a tunnel showing ores carrying copper, silver and gold. Idle.

BLAYNEY MINING & SMELTING CO. **AUSTRALIA.**

Mine office: Blayney, N. S. W., Australia. S. Remfry, manager. Capitalization £100,000. Lands, 50 freehold claims, including the mine variously known as the Blayney, Great Blayney and Annandale, reopened 1897, by the present owners. Has a 40′ vein, carrying chalcopyrite disseminated in andesite, opened by a 390′ shaft. Has steam power and a 50-ton smelter, with a 2 water-jacket furnaces. Produced 418 long tons of copper from 18,666 tons of ore smelted, in 1901.

BLEDSOE GOLD MINING & LEACHING CO. **COLORADO.**

Mine office: Kokomo, Summit, Co., Colo. Henry Pomeroy, superintendent, at last accounts. Ores carry gold, silver, lead and copper.

BLINMAN COPPER MINING CO. **AUSTRALIA.**

Property sold, 1902, to Tasmanian Copper Co., Ltd.

BLUE ACRE COPPER CO. **UTAH.**

Office: 409 Dooly Blk., Salt Lake City, Utah. Letter returned unclaimed from former mine office, Blueacre, Beaver Co., Utah. Henry M. Crowther, president and general manager; Wallace W. Wait, vice-president, secretary and treasurer. Capitalization $600,000, shares $1 par. Lands, 17 claims, area 320 acres, in the Beaver Lake district, showing 5 contact and fissure veins, of which three, of good average width, are being developed, these carrying values estimated by management at 6% copper, 5 oz. silver and $4 gold per ton, from oxide, carbonate and sulphide ores, opened by 4 shallow shafts. Property regarded as promising, though but slightly developed, and work not being pushed with vigor.

BLUE BELL-BELCHER MINING CO. **WASHINGTON.**

Office: care of C. E. Mitchell, Spokane, Wash. Mine office: Republic, Ferry Co., Wash. Organized 1906, under laws of Washington, with capitalization $1,500,000, shares $1 par. Lands, sundry claims, known as the Blue Bell group, carrying 3,000′ of the northwest extension of the Belcher vein.

BLUE BELL COPPER MINING CO.

Office: 36 Swiss St., Cleveland, Ohio. Moribund.

BLUE BELL MINING CO. **CALIFORNIA.**

Office: care of J. J. Sullivan, Quincy, Cal. Lands, sundry claims near Hosslekuse's, Plumas county, California Idle.

BLUE BIRD COPPER-GOLD MINING CO. **UTAH.**

Office: care of M. J. True, secretary and general manager, Salt Lake City, Utah. Mine office: Milford, Beaver Co., Utah. Lands are near the Hickory group of the Majestic company. Main shaft, 275′. Property thought to be valuable, but company in sore financial straits, at last accounts. Idle.

BLUE WING MINE. **NORTH CAROLINA.**

Mine office: Baker City, Granville Co., N. C. Was owned formerly by the Blue Wing Copper Co., and later by the Boston & Carolina Copper Mining Co. Never successful, owing to bad management. Has several shafts, of 100′ to 317′ depth, with 4 levels opened from main shaft, these showing extensive bodies of disseminated bornite, with gangue of quartz and calcite. No stoping has been done below the 150′ level. Idle for several years.

GEWERKSCHAFT BOBERTHALER ERZBERGWERKE. **GERMANY.**

Mine office: Kupferberg, Schlesien, Germany. Dr. Kossman, manager Organized June, 1902. Production, 1902, was 176,368 lbs. fine copper. Employed 21 men, at last accounts.

BOBTAIL MINES CO. **ARIZONA.**

Dead. Lands now held by Big Lead Mining & Smelting Co.

BOCCHEGIANO MINE. **ITALY.**

Owned by Societa Anonima delle Miniere di Montecatini.

KONIGLICHE HÜTTENVERWALTUNG BODENMAIS.. **GERMANY.**

Mine office: Bodenmais, Bavaria, Germany. Ores are iron and copper pyrites, and products are blue vitriol and copperas. Employs about 80 men.

SOCIÉTÉ MINIERE DE BOGOSLOVSK. **RUSSIA.**

Office: 18, Theatre Place, St. Petersburg, Russia. Mine office: Bogoslovsk, Government of Perm, Russia. Employs 1,000 men. A. Hitrovo, chairman; N. I. Vladikin, general manager. Is a small portion of the Bogoslovsk Estate, owned by State Secretary A. Polovtsoff, principal business of the estate being the manufacture of iron, of which 75,000 tons of finished products are turned out annually.

Mines are in four groups, in a distance of three miles. Properties include the Vasilevsky, 600′ deep; Bashmakovsky, 450′ deep; Frolovsky, 750′ deep, and the Bogoslovsky, 630′ deep. These mines have been worked for upwards of a century.

Country rock adjoining the mine is limestone, of Lower Devonian age, through which have erupted granite and porphyry, mingled with tuffs, these overlaid by tentaculite slate, followed by an eruption of augite-garnet rock. The copper ores occur along the contact of augite-garnet with other rocks. Ore is chiefly chalcopyrite, associated with pyrrhotite, and occasional chalcocite, with calcite, quartz, garnet and augite gangue. In 1904 the largest ore body was a lense of 15x50x180′. The Vasilevsky was completely equipped with modern machinery, in 1904, but proved an expensive failure. Ore is hand-sorted on surface, and heap-roasted.

The smelting plant, near the mine, has four 48″ Pilz furnaces, of 28-tons capacity each; one 55-ton 42x144″ Raschette furnace and two 18-ton 41x65″ Raschette furnaces. All furnaces are of brick, without water-jackets. Fuel is inferior charcoal, made from pine and fir wood. Furnaces turn out matte of 22% to 35% copper tenor, slags averaging 0.3%. The matte is bessemerized to 98% blister copper, and refined in brick furnaces to 99.7% copper of excellent quality.

Costs of the Bogoslovsk average as follows, per ton of 2,000 lbs: Mining,

$8.09; hand-sorting, 31 cents; roasting, 17 cents; matte smelting, $2.12; bessemerizing, 89 cents; refining 20 cents; management, 35 cents; administration and miscellaneous, 95 cents; total, per ton of ore, $13.08, equivalent to $0.1378 per pound of refined copper.

Rock in the mines is phenomenally hard. In addition to mining and smelting, the management of the Bogoslovsk lays out money liberally in a variety of ways, and for a variety of purposes other than of a business nature, these including expenditures for roads, schools, a mining college, geological museum, old people's home, charity, free medicines, hospital, etc. Management of the property is progressive. Production, 1903, was 2,749,789 lbs. fine copper.

BOHEMIAN RANGE COPPER CO. **MICHIGAN.**

Office: care of Mathew Van Orden, treasurer, Houghton, Mich. Is a syndicate, formed to explore a tract of 960 acres, lying about 3½ miles east of the Miskwabik. Surface trenching showed several amygdaloid beds. Has an 83′ shaft, with 289′ of drifts, on an amygdaloid bed about 8′ wide. Geology of the property seems uncertain. Work was stopped June 15, 1905.

BOLAÑOS MINING CO. **MEXICO.**

Office: care of M. M. Stephens, president, St. Louis, Mo. Mine office: Bolaños, Jalisco, Mex. W. C. Stith, president; C. W. Simmons, treasurer; Juan B. Yzabal, general manager; Walter R. Hazel, superintendent. Organized, circa 1904, to succeed the bankrupt Bolaños Mining & Milling Co., Management plans installation of hydro-electric power plant, on the Bolaños river.

BOLAÑOS MINING & MILLING CO. **MEXICO.**

Reorganized, circa 1904, as Bolaños Mining Co.

COMPAGNIE DU BOLEO. **MEXICO.**

Offices; 56, Rue de Provence, Paris, France. American office: 614 Sansome St., San Francisco, Cal. Mine office: Santa Rosalia, Baja California, Mex. Paul Mirabaud, chairman; Charles Laforgue, director-general; M. Demorest, secretary; Ernest Michot, mine manager; W. W. Rose, general mine superintendent. Organized May 16, 1885, under laws of France, with capitalization 12,000,000 francs, shares 500 f. par. Debentures, 1,782,000 francs, in bonds of 500 f., bearing 4.5% interest. Dividends have been as follows: 62 francs, 50 centimes each for 1901 and 1902; 104 francs, 16 centimes, in 1903; 135 francs, 41 centimes, in 1904, and 200 francs in 1905. Company is supposed to be controlled by the French house of Rothschild. Enjoys, for a period of 20 years, ending Dec. 17, 1912, exemption from all federal and local taxes, except stamp taxes; exemption of employes from military and civil service, and exemption from customs duties and local dues, and for a term of 50 years, expiring 1942, is exempt from export duties on copper produced and import duties on fuel consumed. In addition to its own mines, the Compagnie du Boleo owns a considerable proportion of the stock issue of the Compagnie d'Inguaran.

Mineral lands are 11 groups, including 3 principal groups of mines known as the Soledad, Providencia and Purgatorio, also a promising new mine, known as La Bricas, and 11,920 hectareas of grazing lands, south of the mines. The

ore occurs in a formation of Tertiary conglomerates, sandstones and tuffs, traversed at certain points by trachyte, the cupriferous tuffs overlying conglomerates of erruptive rock pebbles, and being surmounted by argillaceous tuffs all traversed by fissures. The ores are of great variety, including cuprite, melaconite, azurite, malachite, crednerite, chrysocolla, atacamite, covellite, and chalcocite. There are three cupriferous beds, of which the upper averages about 3′ in thickness, the middle 2′ to 3′, and the bottom bed 2′ to 10′. The middle bed carries oxide and carbonate ores in oölitic concretions, known locally as boleos, hence the name of the mine. The lowest bed is partly below the water-line, and carries sulphide ores, as well as oxides and carbonates. The ore is disseminated through the tuffs in thin, irregular veins, with clay gouge, and has a marked concentration toward the bottom of each bed, where the ore forms compact layers of 6″ to 12″. The main workings are 15 metres to 200 metres above sea-level, the mine being opened by numerous tunnels, and by 7 shafts of the following depths: Sombrero, 98 metres; Carmen, 53m.; Purgatorio, 55m.; Central, 156m.; Amelia, 48m.; Santa Rita, 86m.; San Juan, 86m. The mine is extensively developed, having about 125 kilometres of undergroundopenings.

The mine has complete steam and electric plants, generating about 2,000 h. p. from steam engines, of which 1,500 h. p. is transformed by three-phase dynamos, for distribution to the various mines, and for the electric locomotives used. Owing to the peculiar nature of the mine, all drilling is done by hand, and the richness of the ore is such that no mechanical concentration is attempted, hand-sorting being deemed sufficient. The smelting plant, rebuilt, 1901, has eight 150-ton water-jacket furnaces. The ore is smelted to a matte of 58% to 65% tenor, and about one-third of the matte is reduced to black copper of 89% to 94% tenor, both matte and bars being shipped to Falmouth, England, for refining. German coal and coke are used for smelting and coal briquettes for general fuel. The average net copper return of ore smelted was 4.29% in 1900, 3.95% in 1901, 4.38% in 1902, and 3.97% in 1905. Ore is hand-sorted and machine-briquetted, at a cost of only one franc per ton, the argillaceous gangue serving as a natural binder.

The climate is tropical and the country is extremely arid. Potable water is secured by a pipe-line of 16,074 metres, from a reservoir on the Yaqui plateau, with pumps at Santa Aguede and Santa Rita. There also is a condensing plant, with 4 powerful pumps, for the distillation of sea-water. A private railroad, of 30 kilometres, connects the mines with the smelter at Santa Rosalia, the road having 9 locomotives and 120 cars. At the port of Santa Rosalia, opposite Guaymas, Sonora, is a town of 7,000 people, dependent solely on the mines and smelter. The company has a 340-metre jetty, and owns a sailing vessel of 350 tons register. Extensive harbor improvements are in progress, these including the construction of breakwaters of 650′ and 2,500′, also two new wharves. Miscellaneous enterprises include several general stores, a sawmill, four schools and a hospital.

Wages are $1.25 per day, Mexican, for common labor, with free water and medical attendance, but owing to much higher wages being paid on the mainland, across the Gulf of California, the Boleo is suffering from a scarcity of labor,

and is working only 1,600 men, when 3,000 could be employed to advantage. A large number of Chinese coolies were hired, in 1903-1904, but only a few remained at the mines. Of 500 Japanese imported in 1904, only 40 remained at the mine at the close of the year, and the importation of tropical labor from Tepic also proved a failure. Production of fine copper has been as follows: In 1902, 10,953 metric tons, from 249,895 metric tons ore: in 1903, 10,480 tons copper from 230,490 tons ore; in 1904, 11,122 tons copper, and in 1905, 10,350 metric tons fine copper, equivalent to 22,817,610 lbs. avoirdupois, from 260,694 tons ore. The property is one of great merit, and is ably managed, under more than commonly trying circumstances.

BOLINAS COPPER MINING CO. **CALIFORNIA.**

Office: 253 Spear St., San Francisco, Cal. T. P. H. Whitelaw, president and manager. Lands, sundry claims, showing 9 veins, 6″ to 2′ wide, in serpentine, 4 miles northeast of Bolinas Bay, Marin county, California, on which considerable development work has been done. Ore on the dumps is said to carry 5% to 10% copper. Has a good equipment, including a concentrator. Idle at last accounts, and company refuses to furnish any statement.

BOMPA SYNDICATE. **AUSTRALIA.**

At last accounts was developing a copper property at Glasford Creek, Gladstone district, Queensland, Australia. Showing said to be promising, but district lacks railway connections, which must be had before successful mining can be done upon any considerable scale.

BONANZA CIRCLE MINES. **ARIZONA.**

A nickname for a group of mines at Bisbee, Cochise county, Arizona, which are under the same general management. Properties are described under their respective titles, companies in question being the Calumet & Arizona, Calumet & Pittsburg, Lake Superior & Pittsburg, Pittsburg & Duluth, Pittsburg & Superior American-Saginaw and Warren Realty & Development.

BONANZA COPPER CO. **NEW MEXICO.**

Mine office: Las Vegas, San Miguel Co., N. M. Chas. N. Petteys, president and manager; Geo. H. Hunter, secretary. Has steam power, a small concentrator and a 25-ton leaching plant.

BONANZA GROUP. **ALASKA.**

Owned by the Alaska Copper & Coal Co.

BONANZA MINING CO. **BRITISH COLUMBIA.**

Letter returned unclaimed from former office, Fort Simpson, B. C. Lands were sundry claims in the Cassiar district.

BONANZA MINING CO. **MEXICO.**

Office: care of Chas. Sidlar, secretary, Sunbury, Pa. Mine office: Ameca, Jalisco, Mex. Hon. Thos. Savage, president; E. J. Callahan, general manager. Organized 1905, by shareholders of the Amparo Mining Co., to take over the Barranca mine, bought for $30,000.

BONANZA MINING & SMELTING CO. **WASHINGTON.**

Office: 81 Sullivan Bldg., Seattle, Wash. Lands are the Edison group, 12 claims, in the Silver Creek district of Snohomish county, Washington, opened by tunnels aggregating 2,100′ length, showing auriferous copper ores.

BONANZA MOUNTAIN GOLD MINING CO., LTD. **BRITISH COLUMBIA.**

Mine office: Grand Forks, Yale district, B.C. F. H. Knight, superintendent, at last accounts. Has low-grade auriferous and argentiferous copper ores. Idle.

BONANZA QUEEN MINING CO., LTD. **WASHINGTON.**

Office: Minneapolis, Minn. Mine office: Silverton, Snohomish, Co., Wash. Richard H. Harehold, superintendent. Lands, 8 claims, showing 4 veins, carrying auriferous copper ores. Has about 1,200′ of underground openings.

BONITO COPPER CO. **ARIZONA.**

Mine office: Safford, Graham Co., Ariz. Said to plan installing a leaching plant.

BONMAHON COPPER MINES DEVELOPMENT SYNDICATE, LTD. **IRELAND.**

Offices: Broad Street House, London, E.C., Eng. Mine office: Waterford, County Waterford, Ireland. Sir James Aloysius Power, chairman; H. J. Dixon, secretary; Alfred Thorpe, auditor; Arthur Llewellyn Pearce, consulting engineer. Organized Nov. 16, 1905, with capitalization £30,000, shares £1 par. Lands, 180 acres, on Bonmahon Bay, including the Knockmahon and Tankardstown mines. These properties were worked nearly 50 years, beginning 1824, and have an authenticated production, 1824-1865, of £1,339,232, from which profits of £543,011 are said to have been made. Ore won during this period is said to have averaged 10%, which either is an overestimate, or else was secured by very careful hand-selection. Property shows large reserves of low and medium grade ores, and is considered decidedly promising.

BONNER MINE. **ONTARIO.**

A group of idle claims on Michipicoten Island, Algoma, Ontario.

BONNEY MINING CO. **NEW MEXICO.**

Office: 117 East 18th St., Chicago, Ills. Mine office: Lordsburg, Grant Co., N. M. S. W. Maltbie, president and general manager; J. B. Foster, secretary and treasurer. Lands, sundry claims, showing ores with values mainly in copper. Development was being delayed, at close of 1905, by non-delivery of machinery ordered. Said to plan building a 50-ton concentrator and reverberatory furnace, and installing electric power at the mine and reduction works.

BONNIE BELLE MINING & MILLING CO. **WYOMING.**

Dead. Had claims near the Ferris-Haggarty mine.

BOODLE MINING SYNDICATE, LTD. **COLORADO.**

Offices: 46, St. Mary Axe, London, E. C., Eng. Letters returned unclaimed ed from former mine office, Central City, Gilpin Co., Colo. John Peter Reid, chairman; Chas. Pearson, secretary; W. J. Richards, superintendent. Capitalization, £15,000; shares £1 par; issued, 7,500 shares, 15s. called up. Ores carry gold, silver, and copper. Idle for several years.

BORNITE COPPER CO. **MONTANA.**

Office: 150 Fifth Ave., New York. Mine office: Blackfoot, Teton Co., Mont. J. B. Holmes, president. Capitalization $5,000,000, shares $5 par. Is the successor of the Imperial Montana Copper Mining, Smelting & Water Power Co., which was the successor of the Blackfoot Copper Co. Presumably idle.

COPPER & GOLD MINING CO. **ARIZONA.**
er returned unclaimed from former office, 16 State St., Boston, Mass.
wood Hall, president; Geo. D. Coleman, secretary and treasurer; W.
superintendent. Lands are on Cram Mountain, Maricopa county,
Property idle and company insolvent.

E COPPER & GOLD MINING CO. **WASHINGTON.**
ce: care of C. W. Coffin, president, Bangor, Me. Mine office: Dar-
Snohomish Co., Wash. Wilbur E. Frank, secretary; C. G. Austin, gen-
nager. Lands, 11 claims, in the Stillaguamish district, show large
nising outcrops of auriferous and argentiferous bornite and chalcopy-
evelopment is by tunnel.

E COPPER & GOLD MINING CO. **WASHINGTON.**
nds, 11 claims in the Stilaguamish district of Snohomish county
gton, carrying auriferous bornite and chalcopyrite. Was developing
nsiderable vigor at last accounts.

O KISGRUBER. **NORWAY.**
e office: Bossmo in Ranen, Norway. Works ores carrying 0.5% and
s in copper, and up to 50% sulphur, latter element furnishing the
l values. Production, 1902, was circa 24,000 tons of cupriferous

N & ARIZONA CONSOLIDATED COPPER CO. **ARIZONA.**
tters returned unclaimed from former office, 501-7 Water St., Boston.

N & ARIZONA COPPER CO.
ice: 131 State St., Boston, Mass.

N-ARIZONA GOLD & COPPER MINES CO.
tters returned unclaimed from former office, 405-31 State St.,

N-ARIZONA MINING CO. **ARIZONA.**
ice: 46 Broadway, New York. Letter returned unclaimed from former
fice, Morristown, Maricopa Co., Ariz. Henry Livingston Bowdoin,
nt; T. J. Smith, secretary; W. T. Smith, treasurer and general mana-
rganized 1901, under laws of Arizona, with capitalization $5,000,000,
duced to $500,000, shares $1 par. Lands, 10 claims, area 200 acres, in
lture district, showing 6 fissure veins, of which two, averaging 4′ to 20′
are opened by three shafts of 20′ to 50′, and an 80′ tunnel, showing oxide
bonate ores giving assays of 1% to 40% copper, and $1 to $22 gold
, with a little silver and galena.

N & BRITISH COLUMBIA COPPER **BRITISH COLUMBIA.**
INING & SMELTING CO.
ctically dead. Lost title to property.

N & BRITISH COLUMBIA MINING CO. **BRITISH COLUMBIA.**
ice: 39 Cortlandt St., New York. Moribund.

N & BUTTE MINE. **ARIZONA.**
ter returned unclaimed from former mine office, Gilbert, Arizona.

N & CAROLINA COPPER MINING CO. **NORTH CAROLINA.**
Blue Wing Mine, is idle, and company moribund.

represent about 30 cents silver and 60 cents gold, a total of 90 cents from each ton, the sum, multiplied by the mine's tonnage, represents several hundreds of millions of dollars. It is estimated by the management that copper can be made for 8.5c per pound, from the porphyritic ore, figuring gold and silver toward reducing the cost of the copper, which, at any normal market, would render the property reasonably certain to give $2 to $3 per ton profit upon the ore—a net future profit of anywhere from $600,000,000 to $1,050,000,000. The figures are dizzy, but the ore is there. It might be remarked, however, that it will take one to two centuries, if the mine be opened upon as large a scale as the greatest of the world's present copper producers, to grind up all the ore, and convert it into dividends, so stockholders must not grow clamorous for the entire profit immediately.

Mine equipment includes a 165-h. p. steam plant, with 30-h. p. hoist, 20-drill duplex Rand air-compressor, and 24 power drills. Mine buildings include a 30x45′ carpenter shop, 25x45′ machine shop, 2 smithies, office, laboratory, warehouse and various other small mine structures. An experimental 5-stamp mill is used for testing ores. The Copper Belt railroad connects with the mine's ore-bins, and the company has a 2½-mile standard-gauge private rail line, equipped with 5 locomotives and 50 dump cars. Two 95-ton Vulcan steam-shovels have been bought, and will strip the capping from the porphyry ore body.

The millsite, area 117 acres, with ample water supply, is at Bostonia, on Garfield Beach, upon the western shore of Salt Lake. It was at first planned to build a 500-ton concentrator, at a cost of about $125,000, to reduce the ores developed in the sulphide zone, but the astounding developments on the porphyry zone compelled an entire change of plans, and a 3,000-ton mill is to be built, adjoining the 2,000-ton smelter of the American Smelting & Refining Co. This mill, of steel throughout, will be of the most modern construction and equipment, and will cost upwards of $1,000,000, the parent company having raised £250,000 by a bond issue, to defray the cost of the new mill. It is probable that crushing will be done by stamps, rather than by rolls.

Production has been secured for several years, by ore shipments from the sulphide zone. In 1904 the mine made 3,223,836 lbs. fine copper and in 1905, circa 3,500,000 lbs. Average cost of mining was $1.52 per ton. For the fiscal year ending Sept. 30, 1905, the company made a mining profit of $172,158.13, with expenditures of $23,596.10 for construction account, leaving a net profit of $148,562.03 on the year's operations. The mine employs 125 men on the sulphide zone, and 100 on the porphyry workings. Production is 300 tons of ore daily, to be increased, upon completion of the new Garfield smelter of the American Smelting and Refining Co., to 800 tons daily. The full benefit of the 3,000-ton mill cannot be felt until 1908, by which time the Boston Consolidated should be producing daily about 3,000 tons of 1.75% to 2% porphyritic ore, and at least 1,000 to 1,200 tons of 3% to 3.5% ore from the sulphide zone, and making fine copper at the rate of between 40,000,000 and 50,000,000 lbs. yearly. The mine is one of magnificent capabilities, and the management seems fully alive to them, and fully competent to make the most of them.

will displace cages also, because of their superior quickness in operation, which means lower hoisting charges. The new equipment will include a new boiler plant. Machinery equipment at the old Leonard shaft includes a 50-drill Nordberg compound air-compressor with 15″, 28″ and 42″ steam cylinders, and 19″, 27″, 29″, and 42″ air cylinders, also a duplex Risdon compressor with 14″, 26″ and 30″ steam cylinders and 14″ and 30″ air cylinders. The Allis-Chalmers hoist at the old shaft has 19x48″ cylinders, operating 2 double-deck cages. There also is a 12x14″ Risdon sinking engine. A new and improved precipitatting plant was built at the Leonard, replacing two old plants, in 1905.

The Mountain View Mine has an 1,851′ three-compartment shaft, with 15 exits and connections. On surface is a 115′ steel gallows-frame, and the old 18x48″ Allis engine has been replaced by a new hoist good for 3,000′. Plant includes an Allis air-compressor with 20x42″ steam cylinders and 22x42″ air cylinders, and a 12x14″ Risdon sinking engine.

The Pennsylvania mine has an 1,875′ three-compartment shaft, which was deepened 314′ in 1905. The Pennsylvania is connected underground with the Mountain View, St. Lawrence and Silver Bow No. 1 mines. Surface plant includes a 19x48″ Allis hoist, operating two double-deck cages, a 12x14″ sinking engine and an Ingersoll-Sergeant air-compressor with 20x30″ steam cylinders and 24½x30″ air cylinders.

The West Colusa has a 1,634′ three-compartment shaft, deepened 198′ during 1905, and it is planned to deepen it to 2,000′ during 1906. The mine has seven exits and connections, and is timbered with 10x10″ and 12x12″ square sets. Surface equipment includes a 60′ steel gallows-frame, 13x12″ Iron Bay sinking engine and 20x60″ Nordberg hoist operating 2 single-deck cages.

The East Colusa has a 900′ three-compartment shaft, with four exits, and is equipped with a 16x32″ Griffith & Wedge hoist.

The Moose mine has a 400′ shaft. This is a comparatively new property, but little developed, and was idle in 1905.

Among the miscellaneous properties are the Comanche, slightly developed, and the Badger, which has been leased. The Boston & Montana owns 110 acres of ground on the Meaderville flat, and this has been opened to some extent by two shafts, known as Nos. 4 and 5. This ground, formerly held in poor repute, is much increased in promise by developments of a favorable nature made at other properties in East Butte.

Steam power is used exclusively at the mine. The water from the Mountain View and East and West Colusa mines drains to the 1,200′ level of the Leonard, and is forked thence by a duplex station-pump with Nordberg steam-end 20″x40″x42″ and 7¼x42″ plungers. The steam-end is fitted with Corliss valves and carries a fly-wheel. The water-end was made by the company and cast in the Silver Bow foundry, at Butte. Valves are of the pot form, and the entire water-end is phosphor-bronze, and columns are lined with wood, thoroughly soaked with oil and coated on the inside with hot tar, to withstand the corrosive action of the mine water. Ultimately all of the company's mines will be unwatered from this plant, which is capable of raising 1,000 gallons per minute, against a head of 1,200′. The mine water, which carries considerable cop-

per in solution, is leached on reaching surface, the copper being precipitated on scrap-iron, and product turned into bluestone.

The ore bodies of the various Boston & Montana mines are very extensive, and reserves of smelting grade ore alone are estimated at about 3,000,000 tons. The mine has some stopes of high-grade ore nearly 200′ wide, and is opened several years ahead of any possible productive requirements. Nearly 150 power drills are operated in the various mines of the company, and the production is divided into approximately 85% concentrating ore and 15% smelting ore.

The concentrator and smelter are at Great Falls, 171 miles from the mine, with a freight charge of $1 per ton on ore, over the Great Northern railway, the high freight rate being offset by the advantage of the water-power developed at Great Falls. The concentrator is second only in size to the monstrous Washoe plant of the Anaconda, and is in six sections, each a complete mill in itself, the six having a total capacity of 2,700 tons daily. The building is of wood and is equipped with six 10x20″ and twelve 5x12″ Blake reciprocating crushers, 15 Huntington mills, 18 rolls, 317 sieves, 68 Hartz jigs, 249 Evans jigs, 5 Overstrom concentrators, 42 Wilfley concentrators 10 six-foot vanners and 54 four-foot vanners. Thirty Evans round slime-tables were displaced by 40 Wilfley tables, in 1905.

The smelter treats 300 to 400 tons of high grade ore, and the mill-product of about 2,700 tons of concentrating ore, daily. The plant has 22 McDougall calciners, five 500-ton water-jacket blast-furnaces, four 175-ton reverberatory furnaces and 12 converters of the upright type, each 84x170″ outside dimensions. Product is blister copper of 99% tenor, carrying 40 oz. silver and 0.25 oz. gold per ton. In connection with the smelter there is a very large electrolytic refinery, having a daily capacity of 70 tons of refined copper cathodes, the gold and silver slimes being reduced and parted in a refinery at the plant. The electrolytic plant also has 3 furnaces for melting cathodes for casting the refined copper into wire-bars, cakes and ingots. The electrolytic copper from this plant is very pure, and ranks high in the market. A portion of the blister copper from the smelter is sent to the Raritan copper works, at Perth Amboy, N.J., and the plant also does a very limited amount of custom smelting. Current for the electrolytic plant is carried by solid overlapping slabs of copper. The management is giving consideration to the matter of increasing the present capacity of the Great Falls plant by about 25%, but the plans in that connection are still of a tentative nature.

Power for the concentrator, smelter and electrolytic refinery, is secured from the Black Eagle falls of the Missouri river, these having a 42′ effective head, and generating 8,700 h. p., except at the lowest stages of water. The auxiliary steam plant has 2,400 h. p. in Stirling water-tube boilers, and can supply water for the concentrator, blast-furnace blowers, electric motors, and cranes, in periods of low water.

Fuel consumption for 1905 was 37,000 tons of coal at the mines, while at the reduction works were burned 250 cords of wood, 130,518 tons of coal and 51,372 tons of coke.

For seven years the Boston & Montana was materially hampered in its

operations by litigation with the Montana Ore Purchasing Co., United Copper Co., and various corporations subsidary to the two companies named. This was ended, in February, 1906, by the formation of the Butte Coalition Mining Co., which took over practically all of the Heinze interests in the Butte camp, and the slate has been wiped clear of the disastrous litigation that has done so much harm, in the the past, to all the big mines of the camp.

Production, for the calendar year 1905 was approximately 89,000,000 lbs. fine copper. The management of the mine is all that could be desired.

BOSTON & NEVADA MINING CO. **NEVADA.**

Letter returned unclaimed from former mine office, Yerington, Nevada.

BOSTON & NEW MEXICO COPPER CO. **NEW MEXICO.**

Office: 502 Colonial Bldg., Boston, Mass. John E. Kimball, president; Andrew Swanson, treasurer; C. J. Arthur, secretary and manager. Organized April, 1903, under laws of South Dakota with capitalization $200,000. Lands, sundry mining claims in Socorro county, New Mexico. Apparently a stock-jobbing scheme merely.

BOSTON & PIOCHE MINING & DEVELOPMENT CO. **NEVADA.**

Office: Boston, Mass. Mine office: Pioche, Lincoln Co., Nev. C. S. Miller, general manager. Land, 10 claims, lying to the eastward of the Nevada-Utah property, including the Fannie and Peavine mines, both small producers, in the past. Development is by shaft.

BOSTON & ST. MARY COPPER MINING CO.

Letter returned unclaimed from former office, Great Falls, Montana.

BOSTON-ST. PAUL CONSOLIDATED COPPER MINING CO. **WASHINGTON.**

Office: 712 St. Peter St., St. Paul, Minn. Mine office: Index, Snohomish Co., Wash. Wm. H. Baker, president; O. S. Derringer, secretary. Capitalization $2,000,000, shares $1 par. Lands, 8 claims, adjoining the Ethel. Idle, except for annual assessment work.

BOSTON & SEATTLE MINING CO. **MONTANA.**

Office: care of C. R. Tuttle, secretary, Cleveland, Ohio. Mine office: Elliston, Powell Co., Montana. A. J. Wheeler, president; Robt. I. McKay, treasurer. Lands, 11 claims, 4 patented, circa 12 miles from Elliston, said to show large bodies of low-grade ore, which might be worked advantageously only with railroad facilities, now lacking. Presumably idle.

BOSTON & SEVEN DEVILS COPPER CO. **IDAHO.**

Dead.

BOSTON-SIERRA MADRA MINE INDUSTRY CO. **WYOMING.**

Office: 1118-59 Clark St., Chicago, Ills. Mine office: Slater, Routt Co., Colo. Employs 5 men. Amos Pettibone, president; Lewis A. Pease, secretary, treasurer and general manager; D. E. Turner, superintendent. Organized December, 1900, under laws of Wyoming, with capitalization $1,000,000, shares $1 par. Lands, two claims, area 41.3 acres, in the Three Forks district of Carbon county, Wyoming, carrying 2 fissure veins in andesite, opened by

shafts of 40′ and 160′, and a 400′ tunnel, with 1,200′ of underground openings, showing argentiferous galena, cuprite and chalcopyrite. Is 45 miles from a railroad, but expects rail connections shortly.

BOSTON & SILVERTON MINING & REDUCTION CO. **COLORADO.**

Office: 39 Court St., Boston, Mass. Mine office: Silverton, San Juan Co., Colo. A. A. Lamont, superintendent. Ores carry gold, silver, lead and copper. Has steam power and a 10-stamp mill. Claims too much in its literature offering stock.

BOSTON TERRACE COPPER MINING CO. **UTAH**

Office: 631-53 State St., Boston, Mass. H. T. Gerrish, treasurer. Capitalization $500,000, shares $1 par; issued, $1,400,000. Lands, 11 claims, area 220 acres, in the Newfoundland district of Box Elder county, Utah, having about one-half mile of underground openings, including 10 shafts of 30′ to 285′ depth. Ores have assayed up to 27% copper, 19% lead, 86 oz. silver and $1.20 gold per ton.

BOSTON & TEXAS COPPER CO. **TEXAS.**

Office: 405 Tremont Bldg., Boston, Mass. Letter returned unclaimed from former mine office, Spalding, Archer Co., Texas. E. M. Low, president; Jas. M. Wheaton, secretary and treasurer. Organized 1898, under laws of Arizona, with capitalization $2,500,000, shares $10 par. Idle for some years and apparently moribund.

BOSTON & TEXAS COPPER MINING CO. **TEXAS.**

Presumably dead. Was promoted, in 1898, by Chas. Denison, Hartford Trust Bldg., Hartford, Conn., who advertised it as another Calumet & Hecla. Cannot be learned that any mining was attempted.

BOSTON & TINTIC MINING CO. **UTAH.**

Office: 401 D. F. Walker Bldg., Salt Lake City, Utah. Letter returned unclaimed from former mine office, Silver City, Juab Co., Utah. Wm. H. Tibbals, president and general manager; E. J. Waugh, secretary; R. L. Lyman treasurer. Organized 1899, under laws of Utah, with capitalization $500,000, shares $1 par. Lands, 3 patented claims, area 45 acres, in the Tintic district, opened by a 240′ shaft, showing 2 fissure veins of 8″ average width, 20′ length and 200′ depth, with estimated average values of 35% copper, 4% to 53% lead, 14 oz. to 120 oz. silver and 40 cents to $2 gold per ton. Idle for several years.

BOSTON & WYOMING COPPER-GOLD CO. **WYOMING.**

Office. Custer, S. D. Mine office: Wheatland, Laramie Co., Wyo. W. A. Nelson, president; John I. Hightower, vice-president and general manager; W. E. Benedict, secretary. Organized October, 1903, under laws of South Dakota, with capitalization $2,000,000, shares $1 par. Lands, 6 claims, area 120 acres, known as the Seldom Seen group, showing 3 fissure veins in granite-porphyry, giving assays of 5% to 7% copper, 6 oz. silver and $3 gold per ton, from cuprite, chalcocite, bornite, and chalcopyrite, with sulphide ores predominating. Presumably idle.

BOULDER BAY MINE. **ALASKA.**

Owned by Reynolds-Alaska Development Co.

BOULDER COPPER MINING CO. **SOUTH DAKOTA.**

Office: P. O. Box 118, Custer, S. D. W. A. Nelson, president. Capitalization $1,000,000, shares $1 par. Lands, in Pennington county, South Dakota, are said to show gold and copper ores. Idle.

BOULDER MINING CO. **BRITISH COLUMBIA.**

Office: Oshkosh, Wis. Lands, sundry gold-copper claims in British Columbia.

BOULDER MINING & MILLING CO., LTD. **IDAHO.**

Lands, sundry claims in the Alto district of Idaho, showing ores carrying gold, silver, lead and copper. Presumably idle.

ASMUS BOYSEN MINING CO. **WYOMING.**

Office: 266 South Clark St., Chicago, Ills. Mine office: Thermopolis, Fremont Co. Wyo. Asmus Boysen, president; N. C. Brorson, secretary and treasurer. Organized under laws of Wyoming, with capitalization $25,000,000, shares $100 par. Property consists of the right to locate 640 acres of land on the Shoshone Indian reservation. This is said, by Boysen, to be worth $25,000,000, undeveloped, but as Boysen is in controversy with the Secretary of the Interior as to where this land can be located, the value of the property is much closer to 30 cents. Company advertises, on its show window, to have copper, gold, silver, oil and coal lands.

BOZEMAN COPPER CO. **MONTANA.**

Office: Bozeman, Montana. Organized August, 1904, with capitalization $100,000. Cannot be learned that any work is in progress.

BRADEN COPPER CO. **CHILE.**

Wm. Braden, general manager, E. K. McCann, superintendent. Property is the antigua El Teniente, located in the Cordillera de Graneras, and company is protocolized in Chile. Has constructed a fine wagon-road through the hills, at an estimated cost of $175,000, and has ordered powerful machinery, including hydraulic and electric plants, both for mining and smelting, from the United States.

BRADFORD COPPER MINING CO. **ARIZONA.**

Mine office: Patagonia, Santa Cruz Co., Ariz. Presumably idle.

BRADFORD DEVELOPMENT CO. **ARIZONA.**

Dead.

BRADSHAW MINING CO. **ARIZONA.**

Office: 327 New York Life Bldg., Chicago, Ills. Mine office: Briggs, Yavapai Co., Ariz. Samuel B. Willey, president; Davis Ewing, secretary and treasurer; Frank T. Day, manager; E. W. Fisher, general superintendent; Wm. Roberts, superintendent. Organized 1904, under laws of Arizona, with capitalization $2,000,000, shares $1 par. Property is leased to North American Exploitation Co.

Lands, 23 claims, area 400 acres, also a 40-acre millsite, in the Castle Creek district, showing contact veins of 30′ to 100′ width, between granite and porphyry, carrying galena, cuprite melaconite and malachite, said to give assays of 15% copper, 20% to 40% lead, and $6 to $10 gold per ton, opened by shafts of 150′ and 300′ and tunnels of 150′, 80′ and 60′ esti-

mated by management to show 6,000 tons of ore, with 4,000 tons blocked out for stoping. Apparently idle, and management not well regarded.

BRADSHAW MOUNTAIN COPPER MINING & SMELTING CO. ARIZONA.

Dead. Lands now held by De Soto Mining Co.

BRAGANZA GOLD MINING CO. ARIZONA.

Mine office: Big Bug, Yavapai Co., Ariz. Property is the Henrietta mine, carrying gold-copper ores. Has steam power and a 10-stamp mill.

NEGOCIACION MINERA DE O. y T. BRANIFF y CA. MEXICO.

Office: Rosales 9, Mexico, D. F. Mine office: Cadereyta, Queretaro, Mex. Ores carry silver, copper, lead and zinc. Has steam power and a 6-ton smelter, employing circa 200 men at last accounts.

BRAULIO MADRIGAL TUMBISCATA. MEXICO.

Mine office: Apatzingan, Michoacán, Mexico. Mines are opened by shaft and tunnel. Has steam power.

GEWERKSCHAFT GRUBE BRICCIUS-STOLLN. GERMANY.

Mine office: Annaberg, Saxony, Germany. E. R. Poller, manager. Has argentiferous copper and zinc ores. Idle at last accounts.

GEWERKSCHAFT BRIGITTA ERZBERGWERK. GERMANY.

Mine office: Sennheim, Elsass, Germany. Has lead, copper, and zinc ores. Idle at last accounts.

BRINDLE PUP MINING CO. ARIZONA.

Letter returned unclaimed from former mine office, Dewey, Ariz.

BRISTOL COPPER MINING CO NEVADA.

Office: 201 Mining Exchange Bldg., Denver, Colo. Letter returned unclaimed from former mine office, Pioche, Lincoln Co., Nev. Wm. Gelder, president. Capitalization $2,000,000, shares $1 par. Lands, 440 acres owned in fee, and a half interest in the 80-acre town site of Bristol. Lands adjoin those of Hillside Copper Mining Co., with which the Bristol is closely allied, in ownership and management. Has made small ore shipments, assaying 12% to 30% copper and about 10 oz. silver per ton. Has 2 hoists and power drills. Idle since 1903.

BRISTOL MINE. CONNECTICUT.

An old and idle mine at Bristol, Hartford county, Connecticut. Was worked during the last decade of the Nineteenth Century. Is filled with water, and mine machinery is at bottom of shaft.

BRITANNIA COPPER MINE, LTD.

Offices: 4, Bishopsgate St., London, E. C., Eng. W. E. LaMerton, secretary. Capitalization £90,000, shares £1 par; issued, £7,000. Whereabouts of lands, if any, not learned. Idle and apparently moribund.

BRITANNIA COPPER SYNDICATE, LTD. BRITISH COLUMBIA.

Office: P. O. Box 821, Vancouver, B. C. Hon. Edgar Dewdney, president; W. C. McMeekin, vice-president; Geo. H. Robinson, managing director; J. W. Lee, secretary. Organized under laws of British Columbia, and capitalization increased, August, 1905, to $937,500, in $625,000 preferred stock, shares $625 par, and $312,500 ordinary stock, shares $312.50 par. The ordinary shares will rank for dividends and other respects pari passu with existing ordinary

shares, so soon as same shall have been subdivided into new shares of $312.50 par.

Lands, 7 claims, area 297 acres, lying 4 miles from and about 3,500′ above salt water, at Howe Sound, Nanaimo division, British Columbia, with approximately 8,500′ of the strike of a mammoth mineral zone. The mineralized belt consists of schistose silicious ores, 300′ to 600′ wide, impregnated with copper and iron pyrites, with porphyry to the south and black slate on the north. Ore body is of immense size, amount actually exposed probably exceeding 3,000,000 tons, with a certainty of far larger amounts at depth. Climate is favorable, and mine can be worked open-cast for many years. Mine is opened by tunnels and quarries. The Jane tunnel, 360′ long, has a 600′ trestle, and the Big Bluff tunnel has a 640′ trestle, each with 10-ton self-dumping cars. At the mine are Blake crushers, passing ore to a sorting belt, and thence to a 1,000-ton receiving bin, whence ore is given to the buckets of the tram-line.

Ore is taken from the mine to the mill, at tidewater, by a Riblet automatic aerial tram of 16,800′, in two section, with an intermediate transfer station. The 11,000′ lower section has a drop of 1,800′, and the 5,800′ upper section has a drop of 1,400′. Capacity is 100 tons per hour.

Power is generated to the extent of 500 h. p. from a creek 1,900′ above tidewater, with water-wheels at the beach. Compressor plant at the mine and crushing plant at the mill are driven by electric power. There is a three-mile transmission line, with two 200-kw. 6,600-volt generators.

The 300-ton concentrator is 125′x133′ on the ground, equipped with 60 concentrating tables and Hancock jigs, latter recovering about 70% of the product and giving higher grade concentrates than table concentrators. At the bay is a 250′ wharf with 90′ wing, for shipment of concentrates to the Crofton smelter, which is operated by the Britannia Smelting Co. Ltd., a corporation closely connected with the Britannia Copper Syndicate, Ltd.

At the beginning of 1906, ore production was about 250 tons daily, but it is planned to increase this from time to time to 1,000 tons, which is the present capacity of the plant. The ores of the Britannia carry $10 to $30 per ton in copper and gold values, but while averaging low in grade, the ore bodies are of a large size. The Britannia is exchanging ores with the Brown-Alaska, as the latter lacks silicious sulphides, while the Britannia requires the excess iron of the Brown-Alaska ores. The Britannia has been developed very thoroughly and the methods and equipment are to be commended. The property is one of great possibilities, and as it possesses an excellent management, should be heard from prominently in the future.

BRITANNIA MINING CO. **MONTANA.**

Office: 219 Germania Bldg., Milwaukee, Wis. Letter returned unclaimed from former mine office, Butte, Silver Bow Co., Mont. G. R. Nickey, president and general manager; G. R. Best, secretary and treasurer. Organized Sept. 25, 1892, under laws of Wisconsin; capitalization increased, Mar. 2, 1898, to $350,000, shares $1 par. Has paid dividends of $42,000. Lands, one patented claim, area 13 acres, showing 6 veins, of which 3 parallel veins, of 3′ to 30′ width, are developed by shafts of 100′, 150′ and 400′, with circa 1,000′ of

underground openings, showing ore claimed to give average values of about $35 per ton, mainly in silver. Has steam power.

BRITANNIA SMELTING CO., LTD. **BRITISH COLUMBIA.**

Office: P. O Box 821, Vancouver, B. C. Works office: Crofton, Nanaimo district, B. C. Hon. Edgar Dewdney, president; Geo. H. Robinson general manager;, H. C. Bellinger, consulting engineer; L. E. Gooding, metallurgist; W. H. Yost, master mechanic. Capitalization $625,000, shares $25 par. Is very closely connected with the Britannia Copper Syndicate, Ltd. Lands, 49 acres. The smelter, built 1901-1902, by the Northern Smelting & Refining Co., is located on the eastern coast of Vancouver Island, about 50 miles from Victoria, being connected therewith by rail and water, and is 60 miles by water from the Brittannia mine, and well located for treatment of coast and Alaskan ores. Ore arrives in railway cars, on barges, and is received at a 750′ wharf, with 21′ of clear water alongside, whence cars are hauled up inclined trestles to six 300-ton receiving bins. There also are 8 storage bins of same size, with room for additional bins, all bins having automatic discharge gates.

The sampler, 26x32′ and 84′ high, has two 10x20″ Blake crushers, one pair Davis 12x13″ crushing rolls, Constand automatic sampler, Coolidge sampler, one rubber belt, one canvas belt, elevators, etc., with a 45-h. p. engine and generator, and auxiliary heater. The furnace building, 45x75′, has a 350-ton 42x160″ water-jacket blast-furnace, a 200-ton Garretson pyritic furnace and a 65-ton remelting furnace. The Garretson furnace is designed for both smelting and conversion in one operation, but is not yet perfected, so is used for ordinary smelting. The dust-flue is 10x12x200′ with a 24x40′ dust-chamber, connected with a circular brick stack 12′ in diameter and 120′ high, on a concrete base Slag is granulated and dumped by bucket elevator.

The convertor building, 65x73′, has one stand and four 84x126″ shells, of trough type, converters being tilted by a hydraulic accumulator. Molten matte runs from settlers to converters in a launder, and converter fumes pass through a steel flue into a dust-chamber, with water sprays for laying the copper dust. An electric traveling crane is to be added. The converter has a silica mill, with pneumatic tamper run by a small air-compressor.

The briquetting plant is housed in a 35x73′ building with 78x104′ dry-shed. Equipment includes a No. 7 Chambers briquetting machine and 2 Scott elevating brick-cars, with steam coils in the loft of the dry-shed. Briquettes will be roasted with raw ore. The power plant is 50x60′, with blower-room 40x50′, and boiler-house 40x48′, housing three 140-h. p boilers. The power plant has a 110-kw. Westinghouse current generator, and air-compressors for convertor blast, and Nos. 5 and 8 Connersville blowers, connected with a 54″ blast-pipe, leading to the furnace. Blowers have a united capacity of 9,000 cubic feet of free air per minute.

Miscellaneous buildings include a well constructed office, assay office, and a small but complete machine shop. Buildings are electric lighted throughout.

A quantity of Brown-Alaska ore is received in exchange for Britannia ores, this exchange aiding each property in securing a better mixture for smelting. It is expected that the Crofton plant will do considerable custom smelting

in the future. Blister copper is shipped to New York for refining. This plant is one of the best in Canada, and is well managed throughout.

BRITISH AMERICAN GOLD-COPPER CO. **SOUTH DAKOTA.**

Office: 70 Grand River Ave., Detroit, Mich. Letter returned unclaimed from former mine office, Deadwood, Lawrence Co., S. D.

BRITISH COLUMBIA AGENCY, LTD. **BRITISH COLUMBIA.**

Letter returned unclaimed from former mine office, Alberni, Vancouver Island, B. C. Property includes the Modoc and Kitchener claims, said to give a fair showing of chalcopyrite and auriferous quartz.

BRITISH COLUMBIA CHARTERED CO. **BRITISH COLUMBIA.**

Letter returned unclaimed from former office, Street Railway Chambers Montreal, Quebec. Mine office: Summit, Yale district, B. C. Is commonly known as the B. C. mine. Lands, 8 full and 3 fractional claims, developed by about 7,000′ of underground workings, showing argentiferous and slightly auriferous ores averaging about 5.5% copper. Has a 225-h. p. steam plant, with 4-drill Rand and 5-drill Ingersoll-Sergeant air-compressors.

BRITISH COLUMBIA COPPER CO., LTD. **BRITISH COLUMBIA & WASHINGTON.**

Office: 31 Nassau St., New York. Mine office: Greenwood, Yale district, B. C. Employs 275 to 300 men. F. L. Underwood, president; F. L. Sommer, vice-president; R. H. Eggleston, secretary and treasurer; preceding officers, P. G. Bartlett, C. H. Burke, Edwin Hawley, Colgate Hoyt, Josiah C. Reiff and John Weir, directors; J. E. McAllister, manager; S. Carl Holman, mine superintendent; Frederic Keffer, consulting engineer. Organized, March, 1898, under laws of West Virginia, with capitalization $2,000,000, shares $5 par; issued, $1,825,000. Laidlaw & Co., registrars; Metropolitan Audit Co., auditors. Annual meeting, second Tuesday in February.

Lands, 4 groups, including 26 claims, area 350 acres, and a 60-acre mill-site, in British Columbia, also sundry claims in Washington. Properties are the Motherlode and No. 7 groups, in the Deadwood Camp; the Sunset group in the Similkameen district, near Princeton, B. C.; the Emma mine in Summit camp, and the Apex group near Chesaw, Okanogan county, Washington.

The Motherlode group, on which the principal mining operations are conducted, has an area of 180 acres, showing 5 ore bodies, of which 3 are being developed. Country rocks are limestone, porphyry and eruptive diabases, veins occurring as contacts between limestone and the eruptive rocks. Ore is exclusively auriferous and argentiferous chalcopyrite, occurring with silicious and calcareous gangue, or in magnetite. Ore bodies are irregular in occurrence, main vein, ranging 80′ to 150′ in width, giving average returns of about 1.5% to 1.75% copper, 0.2 oz. to 0.5 oz. silver and $1 to $2 gold per ton. Development is by a 325′ two-compartment shaft, and 3 tunnels, of 500′, 750′ and 900′ length. Underground openings aggregate between 2 and 3 miles, disclosing an enormous tonnage of ore, amounting to fully 3,000,000 tons, with perhaps 1,000,000 tons blocked out for stoping. Tunnels are connected with surface by 6 upraises, of 200′ average height, these reaching quarries on surface, through which ore is milled to the tram-cars in tunnels, giving

cheap mining costs. The shaft is to be enlarged to 4-compartment size, and deepened to 500′. There are 5 hoists, one with 20x42″ cylinders, good for 1,500′. Main tunnel has a double track, equipped with 3-ton tram-cars. At the portal of the tunnel is a 24x36″ Farrel crusher, of 75 tons hourly capacity. Machinery equipment at the Motherlode mine includes a 500-h. p. steam plant, with 30-drill cross-compound straight-line condensing Corliss air-compressor, 10-drill auxiliary compressor, 25 power drills, Robins belt conveyor and Jeffrey bucket elevator. Electrical power, furnished by the West Kootenay Power Co., is being substituted for steam, at the mine, and the compressors and crushers are to be driven by Canadian Westinghouse induction motors. Buildings include a 30x50′ carpenter shop, 30x70′ machine shop, 17 other mine buildings and 20 dwellings for employes.

The Emma mine in the Summit camp, is owned ¾ by the British Columbia and ¼ by the Hall Mining & Smelting Co., but is operated by the former. Mine has a 100-h. p. steam plant and is said to be developing very satisfactory.

The low-grade copper ores of the Sunset group are high in silica, and low in lime and iron.

The No. 7 mine, adjoining the Motherlode, has a 300′ main shaft, with about ½ mile of underground openings. Ores carry values in copper, zinc, silver and gold, in a 7′ vein, with quartz gangue.

The Apex group, 11 claims, at Chesaw, Okanogan county, Washington, is just over the line of the Boundary district, and is in the development stage.

The smelter, at Greenwood, 5 miles from the Motherlode mines, receives ore therefrom over the Canadian Pacific railway, and also does a general custom business. The blast-furnace building, 45x58′, has two 375-ton Allis-Chalmers water-jacket furnaces, 42x150″ at the tuyeres, and by fall of 1906 is to have three 600-ton furnaces, each 48x240″ at the tuyeres. The smelter has a 12x14x620′ dust-flue, leading to a 121′ stack. There are 5 electric locomotives, 3 for ore, and 2 for slag, which is handled in 5-ton side-dumping pots.

The converter building, 45x90′, of steel, has 2 stands, and five 5-ton shells, 84x126″, of trough-type, stands being tilted by hydraulic accumulators, while shells are handled by a 40-ton 4-motor electric traveling crane. First-fusion product is a matte of 45% to 55% copper tenor, which is blown up to 99.5% blister copper, carrying 20 oz. to 50 oz. silver and 10 oz. to 25 oz. gold per ton, which is shipped for refining to the DeLamar works at Chrome, N. J. The converter department has a 72″ silica mill for linings.

There is a briquetting plant and a 3-story 65x79′ sampling mill.

The power-house, 40x81′, has three 100-h. p. boilers and a 150-h. p. Reynolds Corliss engine, but this plant is held in reserve for emergency use, electric power being used throughout the works. The electric power plant secures current, generated 25 miles distant, from the West Kootenay Power Co., and this is utilized by Canadian Westinghouse induction motors. The electric power available for use at the reduction works is 3,000 h. p. There are 2 Connersville blowers and 3 more large blowers of the same make are to be included in the new smelter equipment. Smelting fuel is coke, costing $6.50 per ton.

Surplus earnings for 2 years ended Nov. 30, 1904, were $88,921.80, and net

profit, for fiscal year 1905, was $102,907.05. Production, for calendar year 1904, was 211,864 tons ore, making 5,081,743 lbs. fine copper, 118,418 oz. silver and 36,403 oz. gold. For calendar year 1905, production was 5,601,309 lbs. fine copper, 95,410 oz. silver and 26,226 oz. gold, showing a considerable falling off in the precious metal values of ore treated. The new smelting plant will give a monthly capacity of about 50,000 tons, as compared with 18,000 tons in 1905, and while the effect will not be fully felt in 1906 production, the 1907 output should reach about 15,000,000 lbs. fine copper. The mine, while low in grade, has an immense tonnage assured, and the management seems all that could be desired.

BRITISH COLUMBIA EXPLORATION, LTD. **BRITISH COLUMBIA.**

Succeeded, circa 1905, by Kamloops Mines, Ltd.

BRITISH COLUMBIA & LAKE SHORE COPPER CO., LTD. **BRITISH COLUMBIA.**

Letter returned unclaimed from former mine office, Summit, B. C.

BRITISH COPPER SYNDICATE, LTD.

Offices: care of Paines, Blyth & Huxtable, 14, St. Helen's Place, London, E. C., Eng. Organized, Nov. 9, 1905, with capitalization £500, shares £1 par.

BRITISH GOLD & COPPER MINING CO. **SOUTH DAKOTA.**

Said to have property in the Black Hills district, presumably in Pennington county, South Dakota. Address of company not secured, and no work known to be in progress.

BRITISH GOLD MINES OF MEXICO, LTD. **MEXICO.**

Offices: 65, London Wall, London, E. C., Eng. Letter returned unclaimed from former mine office, Torres, Sonora, Mex. Robt. J. Price, chairman; Geo. Thomson, secretary; John F. Allan, managing director in Mexico. Organized Oct. 27, 1896, with capitalization £100,000, shares £1 par; issued, £70,070. Lands include the Colorado Ures mine, area 100 pertenencias, in Sonora, and a portion of El Carmen mine, at Tlalpujahua, state of Michoacán. Has a 10-stamp mill and smelter, at the Colorado Ures mine. Idle.

BRITISH ORE CONCENTRATION SYNDICATE, LTD. **WALES.**

Office: 1, St. Helen's Place, London, E. C., Eng. Mine office: Beddgelert, Wales. Chas. N. L. Shaw, secretary. Organized, Dec. 21, 1900, with capitalization £150,000, shares £1 par; issued, £85,007. Property is the British rights to the Elmore oil concentration process, and the Sygun, Cribb Dhu and Aran mines, in North Wales, estimated to show ore reserves of 480,000 tons of gold-copper ores, equipped with a 20-stamp mill and 4-unit Elmore oil concentrator, also an interest in a copper mine in Cornwall. Idle.

BRITISH SOUTH AFRICA COMPANY. **RHODESIA.**

Offices: 2, London Wall Bldgs., London, E. C., Eng. This great corporation owns sundry copper fields of promise in northern Rhodesia, which, as developed to the point of actual mining, are set aside as subsidiary companies.

BRITTON GOLD MINING CO. **WASHINGTON.**

Letter returned unclaimed from former mine office, Whatcom, Wash.

K. K. BERG- UND HÜTTENVERWALTUNG BRIXLEGG. **AUSTRIA.**

Mine office: Brixlegg, Tyrol, Austria. Gustav Kroupa, general manager;

Vincens Svoboda, superintendent and mining engineer; Cayetan Hummel, smelter superintendent; Josef Link, purchasing agent. Mining lands, circa 22.5 hectares. Ores are argentiferous and slightly auriferous copper sulphides. Smelter, at Brixlegg, has blast and reverbatory furnaces for smelting, also refining and anode furnaces and a small electrolytic plant. Annual production averages about 5 kgs. gold, 600 kgs. silver, and 225,000 kgs. fine copper.

BROKEN HILL PROPRIETARY CO., LTD. **AUSTRALIA.**

Is no longer a copper producer. Described in Vols. IV. and V.

BROMIDE COPPER CO. **NEW MEXICO.**

Letter returned unclaimed from former mine office, Tres Piedras, N. M.

BROMIDE COPPER & GOLD MINING CO. **NEW MEXICO.**

Had 22 claims, circa 1902, in the Bromide district of Rio Arriba county, New Mexico.

BROOKLYN COPPER & GOLD MINING CO. **WASHINGTON.**

Office: Auditorium Bldg., Spokane, Wash. M. L. Pershell, president; C. von Gilsa, secretary. Capitalization $100,000. Lands are in the Colville Reserve, Washington. Declines to furnish any statement. Presumably idle.

BROOKLYN MINING CO. **CALIFORNIA.**

Mine office: Dale, San Bernardino Co., Cal. H. H. Ames, superintendent. Ores carry gold and copper. Has gasoline power and a 3-stamp mill.

BROOKLYN MINING CO. **COLORADO.**

Mine office: Silverton, San Juan Co., Colo. T. Manion, superintendent. Ores carry gold, silver and copper. Has steam power and a 10-stamp mill.

BROOKLYN MINING CO. **NEVADA.**

Mine office: Contact, Elko Co., Nev. Has gasoline power. Idle.

BROOKS CONSOLIDATED COPPER CO. **MEXICO.**

Office: Bisbee, Ariz. Clinton W. Moon, president; Robert Brooks, vice-president and general manager; G. O. Schaecker, secretary and treasurer; George Motz, superintendent. Employs 12 men. Organized January 25, 1906, under laws of Arizona, with capitalization $1,000,000, shares $1 par, as a reorganization of the Cochise Prospecting, Mining & Development Co. Lands, 3 groups of claims, area 620 acres, in the Ajo Mountains, 40 miles northeast of La Cananea, Arizpe district, Sonora, Mexico. Development is by open-cuts, pits, and short tunnels, showing oxide, carbonate and sulphide ores, latter predominating, ores being estimated to average 8.75% copper, 4% zinc, 12 oz. silver and $5 gold per ton. Vein is very strong, ranging 50′ to 60′ in width, and traceable 1½ miles. Property is considered decidedly promising, and management seems vigorous and businesslike.

BROOKSHIRE MINING CO. **ARIZONA.**

Mine, near Mayer, Yavapai county, Arizona, is operated by the George A. Treadwell Mining Co., which owns 80% of the stock of the Brookshire Mining Co.

BROWN-ALASKA COPPER CO. **ALASKA.**

Mine office: Coppermount, Prince of Wales Island, Alaska. Samuel Silverman, general manager; J. L. Parker, superintendent; Paul Johnson, consulting engineer. Property includes the Mamie group, opened to 500′ level, and

adjoining claims. Ore body on the Mamie is about 40′ wide, giving average assays of 6% copper and $1 gold and silver per ton. Ore is chiefly chalcopyrite, associated with pyrrhotite and pyrite, occurring in lenticular bodies connected by thin seams. Mine is quite extensively opened.

The reduction plant includes a 60x80′ sampler, 50′ high; coke and coal sheds 100x140′; blast-furnace building 60x70′, of steel construction, with room for addition of converter plant; 40x50′ boiler house; 45x50′ engine house and 4 sets of ore bins, 60x120′, with capacity of 10,000 tons, plant being so arranged that material can be handled automatically. The furnace is 44x160″ at the tuyeres, with daily capacity of 400 tons, equipped with mechanical feed Slag is handled by 2 locomotives, drawing 5-ton slag-cars. Coke is brought from Ladysmith, B. C., at a cost of about $6 per ton, delivered. Plant includes a 250-light electrical equipment. Smelter was blown in, December, 1905, and in addition to Mamie ores, does considerable custom smelting. The Brown-Alaska is exchanging ores with the Britannia, at Howe Sound, B. C., as the Brown-Alaska lacks silicious sulphides and the Britannia needs the excess iron that the Alaskan ores furnish. This is considered one of the most promising, as well as among the most advanced, of the Alaskan tide-water copper mines.

BRUCE & CHESSOR MINING CO. **BOLIVIA.**

Mine office: Oruro, Bolivia. Has steam power and employed about 100 men at last accounts, in producing native copper from conglomerate strata, somewhat similar to those found in the Lake Superior district.

BRUCE COPPER MINES, LTD. **ONTARIO.**

Voluntarily liquidated May, 1902. Lands are now held by Copper Mining & Smelting Co. of Ontario, Ltd.

BRUCE MINING CO. **IDAHO.**

Mine office: Junction, Lemhi Co., Idaho. A. T. Bruce, general manager. Has copper-gold ores, opened by tunnel.

BRUGER y CA. **BOLIVIA.**

Office and mine: Toledo, La Paz, Bolivia. Are small producers of copper. Have steam power.

JOSÉ GONZALEZ BRUNO. **CHILE.**

Mine office: Cajon de Maipú, Santiago, Chile. Mines have copper ores, carrying cobalt in connection, and all equipped with steam power, employing circa 50 men, at last accounts.

BRUNSWICK MINING CO. **COLORADO.**

Mine office: Tin Cup, Gunnison Co., Colo. Ores carry gold, silver and copper. Has steam power and a 100-ton concentrator. Presumably idle.

BRUSTAD MINES, LTD. **NORWAY.**

Offices: 62, Leadenhall, London, E. C., Eng. Mine office: Eidsvold, Norway. G. T. Broadbridge, secretary. Organized February 11, 1905, under laws of Guernsey, as a second reconstruction of Golden Mint Mines, Ltd., with capitalization £3,000,000, shares £1 par. Lands, in Eidsvold district, are 8 miles east of Lake Mjosen, and 50 miles north of Christiania. Property was first worked as a copper mine very early in the Nineteenth Century. Development is by tunnel, showing a vein of 30′ width, carrying copper and gold val-

BULLARD BROS. **ARIZONA.**

Office: Martinez, Ariz. Lands, 5 claims, in Cunningham Pass, Harcuvar Mountains, Yuma county, Arizona, said to show considerable ore assaying 7% to 10% copper and $10 in gold and silver per ton.

BULL DOMINGO MINING CO. **WYOMING.**

Mine office: Hecla, Laramie Co., Wyo. John L. Morgan, superintendent, at last accounts. Ores carry copper and gold values. Presumably idle.

BULLION BECK & CHAMPION MINING CO. **UTAH.**

Mine office: Eureka, Juab Co., Utah. P. L. Farnsworth, manager. Secures a limited amount of copper, as a by-product, from auriferous and argentiferous lead and copper ores. Has steam and electric power and a concentrator, employing circa 125 men.

BULLION CITY BORNITE COPPER MINING & MILLING CO. **COLORADO.**

Office: Ebensburg, Pa. Mine office: Aspen, Pitkin Co., Colo. T. V. Hott, president; A. W. Van Houten, secretary and general manager. Employs 6 men. Lands, 11 claims, 7 patented, area 110 acres, 8 miles distant from railroad, with good wagon-road between. Has shafts of 50′ and 90′, showing a 2′ vein of bornite, assaying 25% copper, 53 oz. silver and 1 oz. gold per ton.

BULLION MINING CO., LTD. **IDAHO.**

Office: Wallace, Idaho. B. F. O'Neil, president; James H. Taylor, secretary; D. A. McKenzie, general manager. Organized 1902, under laws of Idaho, with capitalization $1,000,000, shares $1 par. Lands, 4 claims, area 80 acres, showing a 12′ fissure vein, opened by a 100′ shaft and tunnels of 80′ and 170′, giving assays of 14% copper, 12 oz. silver and $4 gold per ton, from sulphide ore. Presumably idle

BULLION MOUNTAINS COPPER CO. **CALIFORNIA.**

Office: 52 Broadway, New York. Mine office: Lavic, San Bernardino Co., Cal. Organized under laws of Arizona, with capitalization $1,500,000, shares $1 par. Was promoted by H. R. Leighton & Co., since bankrupt. Company claims to have mines and reduction works at Lavic, hence presumably succeeded to property of the Peacock Copper Co., which had a 50-ton concentrator, but ran out of ore. Regarded with suspicion.

BULLWHACKER COPPER CO. **MONTANA.**

Office: care of Patrick Clark, president, Spokane, Wash. Mine office: Butte, Silver Bow Co., Mont. Organized March, 1906, under laws of Arizona, with capitalization $1,000,000, shares $1 par. Lands, 2 claims, known as the Bullwhacker and Butte & Boston Placer. A 2′ vein of 10% ore was cut April, 1906, at a depth of 18′ from surface.

BULLWHACKER GOLD & COPPER CO. **ARIZONA.**

Presumably dead.

BULLY HILL COPPER MINING & SMELTING CO. **CALIFORNIA.**

Office: 42 Broadway, New York. Mine office: Winthrop, Shasta Co., Cal. Employs 350 men. D. M. Riordan, president; John B. Keating, general superintendent; H. R. Hanley, assistant general superintendent. Organized 1900, under laws of New Jersey, with capitalization $2,500,000, shares

$25 par. Control of property was changed, 1905, and supposedly is in hands of the General Electric Co., which is variously reported to have paid one to one and a half million dollars for the Bully Hill mine.

Lands, 23 claims, including 18 patented claims, area 213 acres, in the Pittsburg district, circa 25 miles northeast of the Mountain copper mine at Keswick, and supposedly in the same geological horizon. Lands include the Winthrop mine, which is being extensively developed. The Tamarack group, at Shasta City, is supposed to be held under a $10,000 bond.

The Bully Hill was opened as a gold mine, and worked the gossan with rather indifferent results, until copper ores were developed at depth. Bully Hill, with a diameter of about 4,000′, rising 1,200′ above the surrounding country is composed of eruptive rocks, principally basalt and rhyolite, with 3 mineral zones, having a strike of approximately north and south, the ore occurring in shear-zones in rhyolite and meta-diabase dykes, all of superficially slaty structure, the lenses having a clay gouge of 1′ to 30′ on one or both walls. The main lenses have stringers and feeders, ranging from a few inches to 30′ in width, carrying 2% to 30% copper. The principal lenses are 20′ to 300′ long, 2′ to 40′ wide, averaging about 30′, and opened to a depth of 672′. The zone of secondary enrichment shows about 10′ of bonanza ore, the main ore bodies below carrying chalcopyrite associated with pyrite, also a little bornite and chalcocite, with occasional carbonate and oxide ores and native copper. The best ore body gives average assays of about 15% copper, 6 oz. silver, and $8 gold per ton, and shows native copper and native silver in considerable quantities on the 670′ level. Mine is opened by shafts of 600′ and 300′, and by crosscut tunnels of 600′, 800′, 1,000′ and 1,200′, giving a back of about 350′. No. 2, the main working tunnel, 1,000′ long, has double tracks, and a 100x100′ underground station, containing powerful pumping and hoisting machinery. The mine is timbered with square sets. Early in 1906 a large body of high-grade ore was being developed on the lower level of the mine.

The mine and mill have steam and electric power, with 300 h. p. at the mine and 350 h. p. at the smelter. Equipment at the mine includes four 100-h. p. hoists, good for 1,000′ depth each, and 3 Rand air-compressors, of 14 drills aggregate capacity. Buildings, about 20 in number, include an iron-sheathed 40x50′ machine shop.

The smelter, one mile from the mine, receives ore therefrom by the Bully Hill railroad, a 4-mile private line owned by the company. The smelter building, 39x310′ in size, has a 90′ stack, and is terraced throughout, permitting handling of all material by gravity. The reduction plant has roast-stalls in series, with 2 McDougall circular calcining furnaces, and two 42x120″ blast-furnaces, rated at 150 tons daily capacity each. The first product is a 35% to 50% matte, taken in ladles by an electric traveling crane to the converter department, which has two stands, with 68x96″ shells, of barrel type, turning out 99% blister copper, which is shipped to the DeLamar works, at Chrome, New Jersey, for electrolytic refining. The smelter has a small but complete machine shop in connection. Limestone

and iron ore for fluxing are obtained from quarries on the McLeod river, 6 miles distant, but there is a scarcity of suitable ferruginous ores for fluxing the high-grade sulphides produced by the mine.

The mine is said to have been highly profitable to the former owners, but itemized figures are lacking. Annual production probably averages about 5,000,000 lbs. fine copper, and doubtless will be materially increased by the present highly efficient management.

BUNKER HILL MINING & SMELTING CO. **WASHINGTON.**

Office: 5011-1 Madison Ave., New York. Mine office: Index, Snohomish Co., Wash. Charles G. Reiter, president; John D. Campbell, secretary; Wilbur Morris, treasurer; V. V. Clark, general manager; Charles A. McClair, superintendent. Organized October 24, 1902, under laws of Maine, with capitalization $3,000,000, shares $1 par. Lands, 18 claims, area circa 300 acres, also a 5-acre millsite, showing sundry fissures in granite, and contact veins between granite and diorite. Has shafts of 86′ and 600′, with 400′ of underground openings, showing two ore bodies, one a vein of 2′ to 50′ width, carrying chalcopyrite averaging about 1% copper, 0.5 oz. silver and 40 cents gold per ton. Has compressed air and electric power, generated by a water-wheel, with two power hoists, a duplex 10-drill Ingersoll-Sergeant air-compressor and various mine buildings. Concentrator has one Blake crusher, one Austin crusher, 3 sets of rolls, 3 Wilfley tables, slime tables, 2 buddles and a magnetic separator. Shipped 5 car-loads of concentrates in 1905, and began regular shipments January 1, 1906. Plans increasing milling capacity to 100 tons daily and installing a reverberatory furnace, with converter, for making blister copper. Employs 20 men. Property seems conservatively handled and is regarded as promising.

BUNKER HILL-SULLIVAN COPPER MINING CO. **WASHINGTON.**

Reorganized, 1902, as Bunker Hill Mining & Smelting Co.

BUNKERVILLE MINING CO. **NEVADA.**

Mine office: Bunkerville, Lincoln Co., Nev. Presumably idle.

BURLINGTON COPPER MINING CO. **WYOMING.**

Supposed to have property in the Encampment district of Carbon county, Wyoming, but location of lands not learned. Presumably idle.

BURMA COPPER MINES, LTD.

Offices: 716, Salisbury House, London, E. C., Eng. W. T. Warriner, secretary. Organized Nov. 5, 1903, with capitalization £100, shares £1 par. No lands—no business—no excuse for organization.

BURNS MINING CO. **WASHINGTON.**

Mine office: Darrington, Snohomish Co., Wash. Thos. Parks, superintendent, at last accounts. Lands include the Myrtle and Justice claims, opened by tunnel. Presumably idle.

BURNS-MOORE MINING & TUNNEL CO. **COLORADO.**

Mine office: Idaho Springs, Clear Creek Co., Colo. John M. Shaller, superintendent. Ores carry gold, silver, lead and copper. Has water power.

BURRA BURRA COPPER MINING CO. **AUSTRALIA.**

Office: Eagle Chambers, Adelaide, South Australia. Mine office: Burra

Burra, Burra Co., South Australia. T. B. Gall, chairman; V. Lawrence, secretary and treasurer; Wm. West, general manager: Jas. S. Pryor, superintendent. Organized 1901, under No Liability Act of South Australia, with capitalization £120,000, shares £1 par, 10s. paid in; issued, £95,173. Lands, 672 acres freehold, with mineral rights to 11,065 acres of adjoining lands. Country rock is argillaceous slate. Mine is opened by 5 tunnels, of 600′, 300′, 330′, 420′ and 180′. Ores in upper levels were cuprite, malachite, azurite and native copper, occurring in very rich but irregular bunches, lower levels showing bornite and chalcopyrite. Property was opened 1845 and closed 1877, after making 51,662 long tons fine copper, valued at £4,749,224, and paying dividends of £826,585. Was reopened, 1901, by present company. Ore is shipped to Port Adelaide, 107 miles, by rail, for smelting. Fuel used is wood, costing 12s. per cord, and soft coal at 30s. per ton. Average grade of ore now mined is about 2%, and production, 1903, was about 100 long tons fine copper. Workings below water level were filled with water, at last accounts. Has steam and electric power and employed about 30 men, at last accounts.

BURRAGA COPPER CO. **AUSTRALIA.**

Mine office: Burraga, County Bathurst, New South Wales. Property is about one mile east of the "Lloyd" mine, and was opened in 1877. Production was 570 long tons refined copper in 1898. Ores are sulphide, occurring in a belt of highly altered rocks, ranging from porphyry to schistose slates, and carry 1 oz. to 3 oz. silver per ton. Mine is about 800′ deep. Smelter has 3 reverberatory furnaces, using wood for fuel, and product is sent as 47% matte to Lithgow, for refining. Work was suspended latter half of 1904, but production was resumed early in 1905.

BURRO MOUNTAIN COPPER CO. **NEW MEXICO,**

Office: 402-108 Equitable Bldg., Chicago, Ills. Mine office: Silver City, Grant Co., N. M. Nathan F. Leopold, president; Sidney Lang, superintendent. Organized 1904, with capitalization $50,000. Lands, circa 600 acres, in the Burro Mountain district, including the St. Louis mine, held under bond and lease from the Southwestern Copper & Iron Co. The St. Louis is said to have produced more than $1,000,000 worth of ore, and was opened by a 500′ shaft with upwards of one-half mile of openings, when taken by present company, and is said to show large bodies of 7% to 8% ore.

Concentrator was remodeled and doubled in size, to capacity of 150 tons. early in 1906. Machinery plant includes dynamo for power and 300-light generator for lighting. Property also has a 10-ton smelter, which is idle. About 100 men are employed and the mines are being developed systematically. Management is excellent.

BURTON CONSOLIDATED COPPER CO. **WYOMING.**

Letter returned unclaimed from former office and mine, Encampment, Wyo.

BUSTER MINES SYNDICATE, LTD. **ARIZONA.**

Offices: Broad Street House, London, E. C., Eng. J. A. Edmond, chairman; J. R. Shearer, secretary. Capitalization £15,000; shares £1 par; debentures, £1,600, at 10%. Property claimed is a three-fifths interest in a

copper mine, said to be located in the Peck mining district of Arizona. Idle and apparently moribund.

BUTCHER BOY GROUP. **WASHINGTON.**

Mine office: Loomis, Okanogan Co., Wash. Said to be under bond to a Greenwood, B. C., syndicate. Lands, sundry claims in the Myers Creek district, showing auriferous copper ores of fair grade.

BUTLER-LIBERAL CONSOLIDATED MINING CO. **UTAH.**

Mine office: Bingham Canyon, Salt Lake Co., Utah. J. J. Corum, president; C. N. Strevell, vice-president; S. M. Orem, secretary and treasurer; W. C. Orem, general manager; D. R. Williams, superintendent. Organized 1903, with capitalization $500,000, shares $1 par, as a consolidation of the Ben Butler and Bingham mining companies. Lands, sundry claims in the Bingham district, opened by tunnels, showing 2′ of shipping ore in the bottom of a winze from the old Butler tunnel. Has shipped ores to the United States smelter that gave average returns of circa 6% copper, 12 oz. silver and $1 gold per ton. Is expending about $2,500 monthly in development work, and employs circa 20 men. Declared a dividend of one-half cent per share, amounting to $2,500, October, 1903.

BUTLER MINING & MILLING CO. **UTAH.**

Absorbed, 1904 by Butler-Liberal Consolidated Mining Co.

BUTTE & ANACONDA COPPER CO. **MONTANA.**

Succeeded, 1902, by Carlisle Copper Co., since deceased.

BUTTE-ARGENTA COPPER CO. **MONTANA.**

Office: Butte, Mont. Organized, 1906, with capitalization $3,000,000, by J. E. Oppenheimer, Henry Mueller, A. T. Morgan, J. H. King and John N. Kirk, to take over and operate sundry claims in the Argenta district.

BUTTE & ARIZONA COPPER MINING CO. **ARIZONA.**

Office: Prescott, Ariz. Mine office: Mayer, Yavapai Co., Ariz. Ernest A. Haggott, president and general manager; John C. Job, secretary; W. A. Hazeltine, treasurer; preceding officers, Chas. H. Richards, B. O. Kendall and Emil Baxter, directors. Lands, 9 claims, showing 2 parallel veins, said to average 90′ width and to be traceable 3,000′ on company's lands, which lie immediately east of the Arizona Blue Bell Copper Co.

BUTTE & BACORN MINING CO. **MONTANA.**

Mine office: Butte, Silver Bow Co., Mont. F. W. Bacorn, manager. Organized February, 1906, under laws of Maine, with capitalization $5,000,000. Property is options on 13 claims in the northeastern part of Butte, about one half mile north of the Pittsburg & Montana and immediately north of the Butte & London. Claims were located in 1905, ground in that vicinity being considered valueless until recently, but in view of developments of past year, property is by no means without promise.

BUTTE & BINGHAM COPPER CO. **UTAH.**

Mine office: Bingham Canyon, Salt Lake Co., Utah. Idle.

BUTTE & BINGHAM COPPER MINING & DEVELOPMENT CO.

Letter returned unclaimed from former office, 35 Congress St., Boston.

BUTTE & BOSTON CONSOLIDATED MINING CO. **MONTANA.**

Office: 42 Broadway, New York. Mine office: Butte, Silver Bow Co., Mont. Employs about 400 men. Jas. Phillips, Jr., president; Wm. G. Rockefeller, secretary and treasurer; John D. Ryan, general manager; Wm. E. Kane, mine foreman. Organized 1896, under laws of New York, with capitalization $2,000,000, shares $10 par. Debentures, $1,500,000 first mortgage 6% bonds, due April, 1917. Annual meeting, first Monday in April. Is controlled, through ownership of practically entire stock issue, by the Amalgamated Copper Co.

Lands, sundry mines and undeveloped claims in Butte, including the three Silver Bow mines, Michael Davitt, Blue Jay, Berkeley, East Grey Rock and West Grey Rock, also several thousand acres of placer lands.

Silver Bow No. 1 mine has a 3-compartment main shaft of 1,000′. Mine is timbered with 8x8′ square sets, and ore is trammed by horses. Mine is connected underground with the Pennsylvania, Berkeley and Silver Bow No. 3. Has an 800-gallon Riedler pump on the 1,000′ level. This shaft has a 16x42″ hoist, operating two single-deck cages.

Silver Bow No. 2 is idle.

Silver Bow No. 3 has a 4-compartment shaft, 700′ deep, and is timbered with 10x10″ square sets. A 500-gallon Knowles pump is located on the 600′ level. Hoist is a 12x14″ Risdon, operating two single-deck cages.

The East Grey Rock mine has a 3-compartment 1,600′ shaft. A 20x48″ hoist operates two double-deck cages. The surface equipment includes a 28-drill Nordberg air-compressor.

The Berkeley has a 3-compartment 900′ shaft, with 18x32″ hoist operating two single-deck cages. This is one of the best of the company's mines, but operations were greatly hampered, for several years, by litigation with the Heinze companies. The ending of this tiresome and costly fight, in February, 1906, permits the renewal of development work and production.

The Blue Jay mine has a 1,075′ shaft, sunk at an angle of 72°. This has two-compartments to the 600′ level, and three below. Hoist is 16x32″, operating two single-deck cage-skips.

The Kane shaft was about 200′ deep, at the close of 1905.

The Butte & Boston ores are leaner in copper and richer in silver than the average of the Butte camp, the blister copper carrying about 100 oz. silver per ton.

The concentrator and smelter, at Meaderville, were closed down late in 1905, and will be demolished, ores being sent to the Washoe plant, at Anaconda for reduction.

Production, at close of 1905, was about 500 to 600 tons of ore daily, carrying an estimated average of 61 lbs. copper per ton. Output of fine copper for 1905 was about 12,000,000 lbs. For 1906 there should be an increase, due to the removal of the pressure caused by the litigation with the Heinze interests.

BUTTE CENTRAL COPPER MINING & SMELTING CO. **MONTANA.**

Office and mine: Butte, Silver Bow Co., Mont. Samuel A. Hall, general manager. Organized March, 1906, under laws of Montana, with capitaliza-

BUTTE COPPER BELT MINING CO. **MONTANA.**

Office and mine: Butte, Silver Bow Co., Mont. James Talbot, president; Samuel H. Treloar, vice-president; J. R. Siebers treasurer; Russell P. Howard, secretary; A. J. Poser, manager. Organized April, 1906, under laws of Montana, with capitalization $7,500,000. Lands, circa 200 acres, undeveloped, on the continental divide, just east of Butte.

BUTTE COPPER CO. **MONTANA.**

A moribund corporation, once holding bonds on the Jessie and other Butte claims.

BUTTE COPPER EXPLORATION CO. **MONTANA.**

Office: care of N. Bruce McKelvey, secretary and treasurer, 87 Milk St., Boston, Mass. Mine office: Butte, Silver Bow Co., Mont. E. A. Nichols, president; Alfred F. Leopold, vice-president and general manager; preceding officers, Spencer R. Hill, Thomas S. Dee, Frank E. James and Warren Nichols, directors; Geo. T. McGee, superintendent. Employs 30 men. Organized January, 1906, under laws of Montana, with capitalization $500,000, shares $5 par. Lands, 8 claims, area circa 80 acres, lying near to and northeast of the Pittsburg & Montana, also an option on the Six O'Clock group of 7 claims, near the Butte & London, and the Golden Chief claim, which has a 130′ shaft, showing a 30′ vein of low-grade ore at the bottom. The Grand Prize claim is slightly opened by tunnel. The Six O'Clock group has a two-compartment 440′ shaft, sunk by Samuel Newhouse, which at a depth of 40′ cut through a 30′ vein of low grade ore. This shaft has been unwatered, and it is planned to deepen same to 1,500′, and crosscut both north and south at depth of 1,200 feet, or thereabouts, to intercept the copper veins presumably existing, and drift thereon, which is a sound plan of development. Management is good, and property is regarded favorably.

BUTTE COPPER MINING CO. **MONTANA.**

Office and mine: Butte, Silver Bow Co., Mont. John MacGinnis, manager. Organized March, 1906, with capitalization $1,500,000, shares $1.50 par. Lands, sundry claims, including the Robert Emmet No. 1, Robert Emmet No. 2, Anselmo No. 1, Anselmo No. 2, and Trifle, all lying along the Gagnon and Stewart veins. The Emmet was opened to a depth of 300′, showing 7% ore in the bottom, when former operators were driven out by water and lack of cash. The Anselmo mines were considerable producers of silver in the early days of Butte. Management is good and property is regarded as promising.

BUTTE COPPER MINING & SMELTING CO. **MONTANA.**

Office and mine: Butte, Silver Bow Co., Mont. Patrick Mullins, general manager; Samuel A. Hall, secretary; Patrick Wall, superintendent. Property was the Dutton mine, a fractional claim, under lease, in East Butte, which is one of the oldest properties in the camp. Has a 350′ shaft, bottomed in a 6′ vein of rich ore. Apparently the Butte Copper Mining & Smelting Co. has transferred its lease on the Dutton to the East Butte Mining Co.

BUTTE COPPER & ZINC CO. **MONTANA.**

Mine office: Butte, Silver Bow Co., Mont. Clarence B. Wisner, president;

A. L. Bailey, secretary. Organized 1905, under laws of New York, with capitalization $2,500,000. Property is the Emma mine, held subject to a $55,000 mortgage, owned by Charles E. Dickerman. Company is an offshoot of the Montana Zinc Co. The Emma mine, previously held by the Butte Mining & Development Co., has an 800′ shaft, said to show a vein of 300′ width at bottom, this carrying about 2% copper and a fair percentage of zinc. Company is said to plan construction of a mill, to use a new process of zinc reduction.

BUTTE & ELY COPPER CO. **NEVADA.**

Office: care of Chas. L. Scott, secretary, Butte, Mont. Mine office: Ely White Pine Co., Colo. Organized 1905, under laws of Montana, with capitalization $500,000, shares $1 par. Lands, 12 claims, lying between the Nevada Consolidated and Giroux Consolidated. Property is considered well located, and is regarded as promising.

BUTTE GOLD, SILVER & COPPER CO. **WASHINGTON.**

Office: Spokane, Wash. Lands lie about 25 miles from head of Lake Chelan, Washington, showing 2 veins, one 8′ wide, opened by tunnels. Idle.

BUTTE GREEN COPPER CO. **MONTANA.**

Office and mine: Butte, Silver Bow Co., Mont. Samuel A. Hall, general manager. Organized March, 1906, with capitalization $500,000, shares $1 par. Lands include the Green claim, near the Belmont mine of the Butte Coalition. Employed about 20 men, and was claimed to be producing 15 to 20 tons of good copper ore daily, in March, 1906.

BUTTE HILL COPPER MINING CO. **MONTANA.**

Mine office: Butte, Silver Bow Co., Mont. James Higgins, president; Dr. Maurice Eisenberg, vice-president. Organized April 18, 1906, under laws of Montana, with capitalization $5,000,000, shares $5 par. Lands, 11 claims, area 173 acres, lying west of the Butte & Bacorn. In April, 1906, had a 125′ shaft, bottomed in a 40′ vein, showing a 4′ paystreak of ore carrying 30 oz. silver per ton. It is planned to sink 1,000′, and crosscut from that depth.

BUTTE & IOWA MINING CO. **MONTANA.**

Mine office: Butte, Silver Bow Co., Montana. John Hewett, superintendent, at last accounts. Idle and presumably moribund.

BUTTE LODE EXTENSION MINING CO. **MONTANA.**

Mine office: Butte, Silver Bow Co., Montana. Organized April, 1906, with capitalization $500,000.

BUTTE & LONDON COPPER CO. **MONTANA.**

Title changed, circa April, 1906, to Butte & London Copper Development Co.

BUTTE & LONDON COPPER DEVELOPMENT CO. **MONTANA.**

Office and mine: 46 East Broadway, Butte, Silver Bow Co., Montana. Theodore Brantley, president; James H. Lynch, vice-president; W. E. Reynolds, secretary; Alex Johnston, treasurer; preceding officers: Jas. A. Talbot, E. J. Anderson. Chas. F. Booth, Chas. J. Kelly, W. W. McDowell, G. W. Stapleton, B. F. White and Herman B. Eisenberg, directors; Jack Hanley, superintendent. Organized 1905, under laws of Arizona, with capitalization $5,000,000, shares $5 par; issued, $2,000,000. Title changed, April, 1906,

from Butte & London Copper Co. Lands, 113 acres, known as the Greendale placer claims, lying immediately north of the Pittsburg & Montana, and east of the North Butte, supposedly carrying the eastern extension of the Jessie and other claims of the North Butte. Has begun a 3-compartment shaft, in the centre of the property, planned to be sunk 1,200′, thence crosscutting north and south, to intercept extensions of all important veins traversing the tract. Has a temporary hoist, good for 1,000′, and has ordered a new plant, with four 125-h. p. boilers, Corliss double-conical drum hoist, and 5-drill air-compressor. Property is regarded as decidedly promising.

BUTTE & MICHIGAN MINING CO. **MONTANA.**

Mine office: care of Dr. Wm. Bishop, Butte, Silver Bow Co., Montana. Organized January, 1906, with capitalization $1,000,000, shares $1 par, to work sundry undeveloped claims in Leslie Gulch, 6 miles southeast of Butte.

BUTTE-MILWAUKEE COPPER CO. **MONTANA.**

Mine office: care of John F. Cowan, manager, Owsley Blk., Butte, Silver Bow Co., Montana. Organized 1906, under laws of Montana, with capitalization $3,000,000, shares $2 par. Lands, sundry copper claims in the Argenta district of Beaverhead county, Montana, and 5 claims in Butte, lying 1,200′ north of the North Butte, and adjoining the Boston claim of the Alice mine of the Butte Coalition Mining Co.

BUTTE MINE & EXPLORATION CO. **MONTANA.**

Letter returned unclaimed from former office and mine, Butte, Silver Bow Co., Montana. Property was the Pacific mine, in East Butte. Company moribund.

BUTTE MINING & DEVELOPMENT CO. **MONTANA.**

Dead. Went broke on the Emma mine, in Butte, Montana.

BUTTE MONTANA MINING CO. **MONTANA.**

Office: care of C. D. Jordan, St. Louis, Mo. Mine office: Butte, Silver Bow Co., Montana. Organized circa 1906. Lands include the Alexander Scott mine, adjoining the West Colusa, opened by a 700′ shaft, and the Little Annie mine, lying near the Goldsmith, northwest of Walkerville, opened by a 200′ shaft.

BUTTE MOUNTAIN TUNNEL MINING CO. **MONTANA.**

Office: care of C. W. Pomeroy, vice-president, 63-263 La Salle St., Chicago, Ills. Mine office: Butte, Silver Bow Co., Montana. Wm. S. Switzer, president, secretary and treasurer. Capitalization, $3,750,000, shares $1 par. Lands, 7 claims, area circa 102 acres, opened by tunnels of 300′ and 1,300′, showing chalcopyrite, averaging about 2% copper and 2 oz. silver per ton, with small gold values. Idle for several years.

BUTTE NORTHERN COPPER CO. **MONTANA.**

Mine office: Butte, Silver Bow Co., Montana. Morgan Strong, president. G. E. Desnell, vice-president and treasurer; J. B. Carne, secretary. Organized April, 1906, with capitalization $1,500,000, shares $1.50 par. Lands, 3 claims, held under bond and lease, lying between the Butte & London and Butte & Bacorn.

BUTTE REDUCTION WORKS. **MONTANA.**

Owned and operated by Colusa-Parrot Mining & Smelting Co.

BUTTE & ST. LOUIS MINING CO. **MONTANA.**

Office and mine 114 East Broadway, Butte, Silver Bow Co., Montana. C. D. Jordan, president; F. H. Ray, vice-president and treasurer; Samuel M. Roberts, secretary and general manager; T. R. Davey, superintendent. Organized February 14, 1906, under laws of Montana, with capitalization $600,000, shares $1 par. Lands, one patented claim, known as the Kessler, area circa 18 acres, lying north of the Amy and Silversmith and northwest of the Alice mine, in the Walkerville district of Butte, opened by a 100′ shaft, showing gold and silver ores, with copper expected at depth.

BUTTE & SPOKANE MINING CO. **MONTANA.**

Office: care of Patrick Clark, Spokane, Wash. Organized 1905, to take over sundry claims in Butte, Silver Bow county, Montana. Apparently has some connection with the Bullwhacker Copper Co., and may have been replaced by latter.

BUTTE & SUMMIT VALLEY COPPER MINING CO. **MONTANA.**

Mine office: Butte, Silver Bow Co., Montana. Thos. W. Buzzo, president; C. D. Joslin, vice-president; James A. Talbot, treasurer; J. W. Thomas, secretary. Organized April 9, 1906, under laws of Montana, with capitalization $3,000,000, shares $5 par. Lands, 5 claims, area 67 acres, lying near the claims of the General Development Co., opened by a shaft of 125′, on the Saratoga claim.

BUTTE & VERONICA MINING CO. **MONTANA.**

Mine office: Butte, Silver Bow Co., Montana. Lands, 2 claims, area 12 acres, opened by shafts of 30′ and 70′.

BUTTERNUT GOLD & COPPER MINING CO. **ARIZONA.**

Mine office: Humboldt, Yavapai Co., Arizona. Moribund.

BUTTERWORTH MINE. **UTAH.**

Letter returned unclaimed from former mine office, Bingham Canyon, Salt Lake Co., Utah. Claims were slightly developed by tunnel.

BUTTON GOLD MINING CO. **ARIZONA.**

Mine office: Minnehaha, Yavapai Co., Ariz. Ores carry gold, silver and copper. Has steam power and a 5-stamp mill. Presumably idle.

MINA EL CABALLO. **MEXICO.**

Mine office: Indé, Durango, Mexico. Wm. Benton, owner; J. M. De La Torre, superintendent. Has copper-silver ores and steam power. Employed about 40 men at last accounts.

MINA CABALLONA. **MEXICO.**

A prospect, in the Arizpe district of Sonora, Mexico, about 15 miles south of Douglas, Arizona. Shipped some copper ore, carrying gold and silver values, to smelter at El Paso, in 1903. Presumably idle.

CABAÑAS CONSOLIDATED COPPER CO.

Office: care of A. H. Rose, vice-president, 186 First Ave., San Francisco, California.

CABEZAS DEL PASTO MINES. **SPAIN.**

Office: 9, Manriques, Córdoba, Spain. Mine office: Puebla de Guzmán, Huelva, Spain. Owned by C. & J. Sundheim, who have operated the property since 1887. Wm. Guthrie Bowie, general manager; Don Jorge Riecken, superintendent. Lands, 6 concessions, area 104 hectareas, with about 300 hectareas of adjoining lands, having 12′ shafts, deepest 104 metres, with 5,000 to 6,000 metres of underground openings. Ore developed for immediate mining is estimated at 750,000 tons of pyritic ore, and 1,500,000 tons of cupriferous schists. Lenses apparently increase in size, at depth. Mine is opened by overhand stoping, and dry-walling is used in depleted stopes. Ores carry 1.5% to 5% copper, 40% to 52% sulphur and 40% to 44% iron, and the schists range 0.25% to 30% copper. All pyritic ore above 1.5% copper, and all schists above 10% copper, are exported. The lower grade ores are weathered at the mine, to produce cement copper, and the leached ore, free of copper, is sent to France, for the sulphur contained. The water from the mines, where 80,000 to 100,000 cubic metres are in constant storage, carries up to 9 kilograms of copper in solution to each cubic metre, most of which is saved by cementation. The cement copper is washed and classified, the best quality averaging 98.5% copper, which is the best grade of cement copper produced anywhere. Mining by overhand stoping and rock filling is said to prove safer and cheaper than open-cast operations. Surface plant includes Robey hoisting and pumping engines, and the mine has a tramline of 76 cm. gauge, also an aerial tram to the wharves at La Laja, on the river Guadiana. Property is producing on a considerable scale.

CABRALES COPPER SYNDICATE, LTD. **SPAIN.**

Offices: 18, Walbrook, London, E. C., Eng. R. W. Outram, secretary. Organized June 29, 1901, with capitalization £12,000, shares £1 par; issued, £1,207. Inactive and apparently moribund.

EPIGMENIO CABRERA. **MEXICO.**

Office and mine: Guachinango, Jalisco, Mex. Lands, 30 pertenencias, area 74 acres, showing large ore bodies, carrying values in copper, silver and gold. There are some old workings, also limited development of a recent date.

CABRERA MINING CO. **MEXICO.**

Letter returned unclaimed from former office, Velardeña, Dgo., Mex.

MINAS y FUNDICION DE CACOMA. **MEXICO.**

Mexican title of the Cacoma Mining & Smelting Co.

CACOMA MINING & SMELTING CO. **MEXICO.**

Office: 820 Security Bldg., St. Louis, Mo. Mine office: Autlán, Jalisco, Mex. D. P. Richardson, president and treasurer; John Dee, vice-president and general manager; John Nesserly, secretary; John Mann, mine superintendent: M. E. Raines, smelter superintendent. Organized under laws of Arizona, and protocolized in Mexico, with capitalization $1,000,000, shares $10 par.

Lands are various properties in vicinity of Autlán, showing mainly fissure veins, in diorite, these ranging 5′ to 60′ width, ores assaying $5 to $20 gold per ton. Lands average 65 miles distance from Ameca, terminal of the

Mexican Central railroad, and are connected therewith by state wagon road. Railroad is expected to reach Autlán within 2 years, by which time company hopes to be on a regular producing basis.

The Volcancillos mine, area 28 pertenencias, 12 miles west of Autlán, is the principal property. This shows a vein of 6 meters average width, carrying chalcopyrite assaying 3% to 22% copper and $4 to $12 gold per ton. Mine is opened to depth of circa 300′, with about 1,000′ of tunnels and shafts, estimated to show 60,000 tons of ore. The streaks of massive chalcopyrite are selected and matted, copper therefrom being sold to the native metal-workers.

The Purisima, area 24 pertenencias, 12 miles west of Autlán, has a 6′ vein of auriferous chalcopyrite, opened by 400′ of tunnels, and is said to have produced $60,000 gold from oxidized surface ores.

The El Paso mine, area 40 pertenencias, 12 miles west of Autlán, shows an 8′ vein carrying copper, lead, silver and gold, values being principally in silver-lead, opened by a 100′ shaft.

La Veta Grande mine, area 60 pertenencias, 30 miles west of Autlán, on the Autlán river, near the proposed railway line, is said to have a 200′ vein showing bornite at surface and lower grade iron-copper pyrites at depth, all with gold values. Several thousand horse power is available from the river, at this point.

The Palestina mine, area 8 pertenencias, 12 miles west of Autlán, has a vein of 6 metres width, opened by a tunnel showing auriferous copper ore. Free gold has been taken in considerable quantities from the surface.

The Olvidado mine, area 4 pertenencias, 12 miles west of Autlán, has an 8′ vein of auriferous copper ore, slightly developed by tunnel.

The St. Louis group, area 2 pertenencias, 12 miles west of Autlán, is a quarry of fluxing ore, carrying about enough silver to pay for mining.

El Cajon mine, area 8 pertenencias, 12 miles west of Autlán, has a 25′ vein of argentiferous and cupriferous hematite, developed by shafts, which is valuable for fluxing ore.

Miscellaneous properties are La Junta, 6 pertenencias; San Carlos, 15 pertenencias; San Juan, 15 pertenencias; San José, 40 pertenencias; Anaconda, 11 pertenencias; El Tigre, 75 pertenencias, and Ouelitlán; 30 pertenencias. More or less work has been done on all of these last-named properties, which are antiguas, formerly worked above the sulphide zone. Efforts of the company are being centered on development, the limited production secured being won mainly to afford employment for the native metal-workers of the Autlán district. Company plans building concentrators at three different points. Present plant consists of a small mill and smelter, equipped with crusher, rolls, jigs and 10-ton furnace. Management seems good, and property is considered of much more than ordinary promise.

CACTUS GROUP. **UTAH.**

Owned by Newhouse Mines & Smelters.

CACTUS SMELTING & COPPER CO. **UTAH.**

Absorbed by Royal Copper Mining Co., now Newhouse Mines & Smelters.

CADENA DE COBRE MINING CO. **MEXICO.**

Office: care of John W. Gillingham, secretary, Bisbee, Ariz. Organized December 24, 1904. Lands, circa 250 pertenencias, in the Sahuaripa district of Sonora, Mexico, developed by 3 tunnels, said to show good ore. Company paid for lands, but former officers seems to have vested titles in their own names. Ernest E. Hughes, former president, was deposed early in 1906, and present management is suing former officers, to cancel the issue of 550,000 shares of stock, which said officers voted themselves as a gratuity. According to statement of new management, the old officers simply stole the 550,000 shares. The case seems a parallel to that of the South Bisbee. Property presumably valuable.

SOCIEDAD ANONIMA MINAS DE CALA. **SPAIN.**

Offices: Bilbao, Vizcaya, Spain. Mine office: Cala, Santa Olalla, Huelva, Spain. Conde de Rodas, president; Don Emilio Vallejo, secretary. Organized August 31, 1900, under laws of Spain, with capitalization 15,000,000 pesetas. Property is a group of 8 mines, area 346 hectareas, at Cala, carrying magnetic iron ore and cupriferous pyrites, ore bodies apparently being extensive. Company is supposed to have built a 97-kilometre railroad, from the mines to San Juan del Aznalfarache, on the Guadalquivir river, in the adjoining province of Sevilla.

CALABASAS COPPER CO., LTD. **ARIZONA.**

A Douglas-Lacey swindle, in Pima county, Arizona. See description of Amalgamated Gold & Copper Co.

CALAVERAS MINING ASSOCIATION. **NEW MEXICO.**

Mine office: Alamagordo, Otero Co., N. M. E. A. Hersperder, superintendent, at last accounts. Lands include the Black Burro mine, showing sulphide ores of copper and lead. Presumably idle.

CALCANTE MINES. **ITALY.**

An idle property near Traves, Torino, Italy, in the western Alps of Piedmont. Formerly was a considerable producer of nickel, cobalt and copper, latter from chalcopyrite, found in stratified archaic rocks.

CALEDONIA COPPER CO., LTD. **NEW CALEDONIA.**

Offices: 79½, Gracechurch St., London, E. C., Eng. Mine office: Noumea, Diahot district, New Caledonia. Geo. Allan, president; James W. Chenhall, consulting engineer; A. J. Lindsay-Simpson, secretary. Lands, circa 4,000 acres, including the Ao and Pilou mines. Direct title is held by Les Mines de Cuivre Pilou, Ltd., entire stock issued of which is owned by Caledonia Copper Co., Ltd. Capitalization £750,000, shares £5 par. Debentures, £100,000 authorized, £46,000 issued, at 7.5%. The Pilou mine has been extensively developed, and is connected by tunnel with the Ao, 2.5 miles distant. Main shaft, 240 metres. Ores are carbonates and oxides, near surface, succeeded at slight depth by argentiferous chalcopyrite and galena. Ore is dressed to tenor of 13% to 15% copper, the concentrated ore carrying 200 to 400 grams of silver per ton from the sulphide ores, and 2 to 4 grams gold per ton from the oxidized surface ores. Plant includes a 200-ton concentrator. Company was promoted by the notorious London & Globe Fi-

nance Corporation, Ltd., and apparently was robbed before born. Property has been seized by mortgage-holders.

CALEDONIAN EXPLORATION CO. **MEXICO.**

Mine office: San Nicolas del Oro, Guerrero, Mex. T. B. C. Murphy, superintendent. Property is the Nantzintla mine, carrying ores of gold, silver and copper, opened by tunnel.

CALEDONIAN MINING CORPORATION, LTD. **NEW CALEDONIA.**

Voluntarily liquidated, December, 1903.

COMPAÑIA MINA DE CALIFORNIA. **MEXICO.**

Letter returned unclaimed from former mine office, Cumuripa, Sonora, Mexico. Organized 1901, with capitalization $1,000.000. Lands, 20 pertenencias.

CALIFORNIA-AMECA MINING CO. **MEXICO.**

Mine office: Ameca, Jalisco, Mexico. G. W. Whitney, manager. Was developing the San Pedro copper mine, at last accounts.

CALIFORNIA & ARIZONA COPPER MINING CO. **ARIZONA.**

Apparently succeeded by California & Arizona Development Co.

CALIFORNIA & ARIZONA DEVELOPMENT CO. **ARIZONA.**

Office: care of Pritchard & Hagen, Bisbee, Ariz. Apparently is successor of the California & Arizona Copper Mining Co. Lands, presumably 7 claims, in the Huachuca Mountains, Cochise county, Arizona, which were under option for a time to the Mitchell Development Co., and later reverted to original owners.

CALIFORNIA, ARIZONA & HECLA MINE. **ARIZONA.**

Mine office: Welton, Yuma Co., Arizona. Lands, sundry claims, opened by tunnels of 100′ and 160′. Was developing with a small force, at close of 1905.

CALIFORNIA COPPER CO. **CALIFORNIA.**

Office: 31 Nassau St., New York. Letter returned unclaimed from former mine office, Daulton, Madera Co., Cal. Property is the Ne Plus Ultra and adjoining claims. Has a 100-ton smelter, but ores proved refractory, and unsuited to economical extraction. Moribund.

CALIFORNIA COPPER KING CO. **CALIFORNIA.**

Letter returned unclaimed from former office, 218 South Broadway, Los Angeles, Cal. Lands were 21 claims, in two groups, on Pahlen and McCoy mountains, Riverside county, California, opened by shafts, showing various ore bodies, of 4′ to 40′ width.

CALIFORNIA GOLD & COPPER CO. **CALIFORNIA.**

Mine office: Spenceville, Nevada Co., Cal. C. C. Bitner, president and general manager. Has auriferous and argentiferous copper ores, with water and electric power.

CALIFORNIA GOLD & COPPER CO. **CALIFORNIA.**

Office: care of H. C. Hibbard, secretary, Riverside, Cal. A. H. Cram, president and general manager; C. W. Page, vice-president. Organized 1904. Lands, sundry claims in eastern San Bernardino county, known formerly as the Von Trigger mine, said to show 7 parallel veins carrying slightly

auriferous copper ores, which are carbonates to a depth of 80′, and sulphides below. Two veins have been slightly opened, these giving average assays of 10% copper. Has a 15-h. p. Fairbanks & Morse gasoline hoist, with about 1,000′ of underground openings.

CALIFORNIA IMPROVEMENT CO. **CALIFORNIA.**

Office: 101 Sansome St., San Francisco, Cal. Mine office: Mills College, Alameda Co., Cal. F. M. Smith, president and general manager. Property is the Leona Heights mine, in the outskirts of Oakland, producing cupriferous iron pyrites, carrying 1% to 2% copper and averaging about 45% sulphur. Production, 1905, was 4,303 tons of cupriferous pyrites, valued at $18,958.57, shipped crude to acid-makers.

CALIFORNIA MINING CO. **UTAH.**

Mine office: Park City, Summit Co., Utah. S. Levy, superintendent. Ores carry gold, silver, lead, copper and zinc. Has steam power and a 50-ton concentrator.

CALIFORNIAN COPPER SYNDICATE, LTD. **CALIFORNIA.**

Absorbed, 1902, by Fresno Copper Co., Ltd.

MINA DA CALINNHA. **PORTUGAL.**

Office: care of M. Paul Chapuy, manager, Santa Appolonia, Lisbon, Portugal. Supposedly owned by a French company. Exports limited quantities of cupriferous iron pyrites to England.

CALSTOCK TIN & COPPER CO., LTD. **ENGLAND.**

Offices: 16, Place Vendome, Paris, France and 30, Moorgate St., London, E. C., Eng. Mine office: Calstock, Cornwall, England. G. Robinson, chairman; C. Fred Thomas, mine manager; John A. Russell, secretary. Organized May 5, 1900, with capitalization £60,000, shares £1 par; issued, £57,707. Debentures, £16,070, at 5%. Property is the Prince of Wales tin mine, and sundry mineral licenses on adjoining property. Has a 56-stamp mill. Presumably idle.

CALUMET & ALGOMA DEVELOPMENT CO. **ONTARIO.**

Succeeded, 1903, by Hermina Mining Co., Ltd.

CALUMET & ALGOMA MINING CO. **ONTARIO.**

Office: care of Lucas Hermann, Calumet, Mich. Joseph Hermann, chairman. Organized, circa 1905, presumably under laws of Ontario, with capitalization $1,000,000, shares $1 par, as successor to the Copper Queen Mining Co., Ltd. Lands, 1,166 acres, in Morin township, Algoma, Ontario, 25 miles north of Bruce Station, showing a 45′ fissure vein, traceable circa 3 miles, carrying medium grade chalcopyrite, more or less auriferous, with occasional bornite and malachite, and giving assays of 5% to 25% copper. Has two shafts, No. 1, nearly vertical, being 138′ deep. There also are 2 tunnels, longest 125′. Lands are heavily timbered and well watered. Company was badly pressed for funds, at last accounts.

CALUMET & ARIZONA MINING CO. **ARIZONA.**

Office: Calumet, Mich. Mine office: Bisbee, Cochise Co., Ariz. Works office: Douglas, Cochise Co., Ariz. Employs about 1,000 men, of whom 625 are at the mine and 375 at the smelter. About 6% only of the force is Mex-

ican labor. Chas. Briggs, president; James Hoatson, vice-president; Thos. Hoatson, 2d vice-president; Louis W. Powell, 3d vice-president and general manager; Gordon R. Campbell, secretary; Peter Ruppe, treasurer; preceding officers, Thos. F. Cole, Chester A. Congdon, Chas. d'Autremont, Jr., and Geo. E. Tener, directors; James Wood, smelter superintendent; Henry B. Paull, auditor; J. N. Kinsey, smelter clerk; W. E. McKee, master mechanic; F. E. Whiteley, engineer; John Collins, mine foreman. Organized March, 1901, under laws of Arizona, with capitalization $2,500,000, shares $10 par; issued, $2,000,000. Annual meeting, second Monday in April. Merchants & Miners Bank, Calumet, Mich., registrar. Is listed on the Boston Stock Exchange. Has circa 2,100 shareholders. Paid dividends of $1,700,000 in 1905; has paid total dividends of $3,400,000, to close of 1905. Ended 1905 with liabilities of $187,497.33, and with quick assets of $2,625,758.29.

Lands, 12 claims, area 178 acres, patented, adjoining the Copper Queen Consolidated, at Bisbee, also a 640-acre smelter-site, at Douglas. The shafts are in limestone, showing occasional porphyritic intrusions, and are not far distant from a porphyry contact. Side-line agreements exist with the Copper Queen, insuring freedom from possible litigation, and a preservation of the present neighborly relations. The surface gives small indications of values, showing but small and infrequent outcrops, the existence of the magnificent ore bodies since opened having been inferred correctly from the underground developments in the adjoining shafts of the Copper Queen, and from careful study of the general geological conditions of the district. Ore occurs in highly irregular bodies, the mine showing native copper, cuprite, melaconite, malachite, azurite, chalcocite and chalcopyrite, usually with a talcose gangue, and with considerable hematite and manganese ores, the latter carrying malachite in small disseminated nodules, and frequently averaging 10% to 18% in copper. The ore, which is practically self-fluxing, averages about 2 oz. silver and 0.05 oz. gold per ton, as smelted. The ore bodies are extensively developed, but are not largely blocked out, owing to the constant shifting of the ground, caused by the creeping of the mountain above, as is the case at the neighboring Copper Queen mine, requiring very heavy timbering and constant care for all openings, which renders it prudent to keep costs down by blocking out ore but a comparatively short time ahead of actual stoping requirements.

The original mine is on a single claim of 20 acres, the Irish Mag, on which a finely timbered 4-compartment vertical shaft of 1,298′ depth is sunk, in hard limestone throughout, except where cutting the various ore bodies, rendering it safe from drawing. The mine is opened by drifts and crosscuts on the 750′, 850′, 950′, 1,050′, 1,150′, and 1,250′ levels. The upper levels show exceedingly rich ores, there being whole stopes assaying 40%, and even 50% copper. A good ore body has been opened on the Pride claim, by a drift from the 1,250′ level of the Irish Mag shaft. An auxiliary double hoist is installed on the 1,000′ level of the Irish Mag shaft. When the new machinery at the Oliver shaft is in full running order, the Mag shaft will suspend opera-

tions for a few weeks, for lining up. The shaft has not been idle a day, for nearly 5 years, and has given magnificent service.

The Oliver shaft is 1,150′ deep, and is bottomed on the same level as the Irish Mag, the collar of the Oliver being 150′ lower than the Mag, and 50′ higher than the collar of the Lowell shaft of the Copper Queen. The Oliver shaft develops both of the Senator claims, and shows magnificent ore bodies. This shaft first cut ore at 710′, or about 300′ higher than in the Lowell. The lower workings show rich sulphides, and in order to save the high-grade ores in the upper levels, for fluxing and enrichment of the average furnace charges, development is being pushed more rapidly in the sulphide zone than above, yet practically all of the oxidized ores now smelted come from development work alone. It is planned eventually to sink both shafts to a depth of 2,000′, or even more, should the ore bodies hold out. The shafts have 4 compartments and make very little water, but the mine may become wet at a depth of 1,500′ or more. The ground is exceedingly soft, owing to the amount of talc gangue in the ore bodies, and requires heavy timbering. Timber is secured from a great distance, and, to guard against emergencies, large stocks are carried.

Rich ore has been found on the Buckeye claim, by crosscuts from the Oliver shaft of the Calumet & Arizona, and from the Cole shaft of the Lake Superior & Pittsburg. The ore body is of large size as well as of good grade.

The southernmost claim is the Gibraltar, wedged between the lands of the Pittsburg & Duluth and Lake Superior & Pittsburg properties, the Gibraltar claim also having shallow exploring shafts and open-cuts showing iron and a little low-grade copper ore, of promising appearance. The company also owns two detached tracts, one being the Wagner and Hope claims, about 2,000′ southwest of the Irish Mag shaft, and adjoining the Pittsburg & Duluth mine. These have been opened by a crosscut from the Mag shaft, traversing 600′ of Copper Queen ground, and stopping about half way across the Hope and Wagner. This has shown nothing of importance.

Developments in the Junction and Calumet & Pittsburg mines give a prospective value to the Washington, Angel and Old Republic claims, lying on the porphyry side of the gulch, which were considered of little promise when bought, and which were secured mainly as a possible smelter site.

The main surface plant is clustered about the Irish Mag shaft, on a steep hillside, graded for the purpose. The shaft has a 78′ steel gallows-frame and a 114′ ore bin, with a 20x60″ direct-acting Nordberg hoist, capable of raising a 3-deck cage at the rate of 2,000′ per minute, from a depth of 1,600′. This hoist has raised about 600 tons of ore daily, from an average depth of nearly 1,000′, beside caring for men, timber and tools—a record never before made by one shaft in Arizona. The compressor plant includes a new 35-drill air-compressor and 3 class WB2 Sullivan straight-line compressors. Much of the ore is so soft that it can be bored with a breast-auger, thus reducing requirements in the way of air for power drills.

The plant includes carpenter and machine shops, smithy, timber-mill for framing mine-sets, office building, warehouse, etc. Four 40-h. p. Buffalo ver-

tical engines, direct-connected to 25-kw. 115-volt Crocker-Wheeler generators, furnish electric light, and power for the ventilating fans. An automatic telephone system has 25 stations underground and on surface, and is connected with the smelter at Douglas. There is a substantial hospital for mine employes, and a model changing-house, with hot and cold running water, tub and shower baths and lockers for 500 men. There are hose-houses and hose-carts at each shaft, and each shaft has a direct pipe-line to big storage tanks, giving a pressure of 100 lbs., all hose-fittings being made to connect with those of the Bisbee fire department.

The Oliver shaft will have its permanent equipment completed in the spring or summer of 1906. The power plant will include four 280-h. p. marine boilers, burning crude petroleum, and a 35-drill Sullivan Corliss cross-compound two-stage air compressor, with 17x34″ steam cylinder and 20x34″ air cylinder, with a piston displacement of 6,600 cubic feet of free air per minute.

The smelter, at Douglas, 25 miles from the mine, receives ore over the El Paso & Southwestern railway, under a very favorable freight rate. The first stack was blown in Nov. 15, 1902. Equipment includes four 300-ton water-jacket blast-furnaces, with foundation laid for the fifth, and material for the furnace on the ground. One furnace runs on ores of the Lake Superior & Pittsburg and Pittsburg & Duluth mines. An addition to the smelting capacity was made, 1905–1906, under phenomenal difficulties, no less than five different carloads of material being so badly wrecked that it was sent back to the manufacturers for rebuilding, by no less than five different railroad smashups. Matte is discharged into tilting wells, and taken thence by electric traveling cranes, 3 in number, to the converters, of which there are 4 stands, which turn out 99.2% blister copper carrying small gold and silver values. The converter building was widened 15′ in 1905, and 2 cranes added.

The power plant at the smelter was enlarged in 1905, and a new boiler-house built, this housing five 250-h. p. boilers and two 280-h. p. boilers. There is a 400-h. p. engine running two Nordberg air-compressors with cross-compound steam ends, having 22x42″ cylinders, with 48″ stroke, the air cylinders being 48x48″, maintaining a 12-lb. blast pressure. Petroleum is used for fuel, there being four 45,000-gallon oil tanks for storage. Water in ample supply is secured from flowing artesian wells, of 450′ average depth. During 1905 a new steel dust-chamber was added, and a new steel smoke-stack, 200′ high and 16′ in diameter, was built. At the smelter are two 16-room lodging houses and a number of dwellings. Blister copper is shipped for refining to the Nichols Chemical Works, New York.

Production, 1905, was 31,772,896 lbs. fine copper, a small gain over 1904, secured from 202,952 tons smelted, giving an average return of 7.82%, as against 7.70% in 1904. Average price received for copper sold, 1905, was 14.93 cents per pound. Net earnings for 1905 were $2,315,000, or $11.50 per share, giving an average cost, per pound of copper, of 7.03 cents, all construction costs, which were considerable, being charged direct to operating expenses.

The Oliver shaft was supplying about one-third of the total ore production of the mine, early in 1906. With both shafts in full commission, the mine should show an increased output for 1906, and a further considerable gain in 1907.

Under the same general management as the Calumet & Arizona, are the Lake Superior & Pittsburg, Pittsburg & Duluth, Calumet & Pittsburg and Junction Mining companies. The four last-named companies, the first two of which became producers in 1905, will be consolidated in 1906, as the Superior & Pittsburg Mining Co. The Calumet & Arizona is one of the best among the world's big copper mines, and it has a management of which a similar high opinion can be expressed with truth.

CALUMET & BISBEE DEVELOPMENT CO. ARIZONA.

Office: Calumet, Mich. Mine office: Bisbee, Cochise Co., Ariz. Frank S. Carlton, president; Wm. R. Oates, secretary; Geo. O. Beehler, manager. Organized Oct. 20, 1902, under laws of Arizona, with capitalization $400,000, shares $10 par; 15,000 shares issued and fully paid. Lands, 4 claims, at Dos Luis, adjoining the Lake Superior & Pittsburg. Has a 960′ main shaft. Idle, owing to lack of funds. Fully described in Vol. IV.

CALUMET & BUTTE DEVELOPMENT CO. MONTANA.

Office: care of Herman Bibber, Calumet, Mich. Mine office: Butte, Silver Bow Co., Mont. A. M. McKenzie, manager. Organized 1906, under laws of Arizona, with capitalization $200,000, shares $10 par. Lands, 2 claims, known as the Albert and Richelieu, near the Altoona group, slightly developed by 2 shafts, showing malachite, azurite and native copper.

CALUMET & COCHISE DEVELOPMENT CO. ARIZONA.

Liquidated, 1905, with all debts paid and a dividend of 47½ cents returned to shareholders. Fully described in Vol. IV.

CALUMET COPPER CO. COLORADO.

Office: 131 La Salle St., Chicago, Ills. Mine office: Turret, Chaffee Co., Colo. Hon. Wm. E. Mason, president; David W. Medbury, secretary; Elmer E. Briggs, general manager; G. W. Mendenhall, superintendent. Lands, 3 claims, known as the Copper King group, on Middle Mountain, showing schistose veins in a formation of micaceous granite, with porphyry intrusions, carrying auriferous and argentiferous copper oxides and sulphides. Development is by incline shafts of 40′ and 85′. Presumably idle.

CALUMET COPPER MINING CO. WASHINGTON.

Dead. Property sold, under foreclosure, to Mt. St. Helens Cons. Mg. Co.

CALUMET & DULUTH DEVELOPMENT CO. ARIZONA.

Dead. Options on lands near Bisbee were forfeited.

CALUMET & HECLA MINING CO. MICHIGAN.

Office: 12 Ashburton Place, Boston, Mass. Mine office: Calumet, Houghton Co., Mich. Mill office: Lake Linden, Houghton Co., Mich. Smelter offices: Hubbell, Houghton Co., Mich., and 1 Austin St., Buffalo, N. Y.

Alexander Agassiz, president; Col. T. L. Livermore, vice-president; Quincy A. Shaw Jr., second vice-president; Rudolph L. Agassiz, third vice-president; preceding officers, Francis L. Higginson, Francis W. Hunnewell

and Jas. N. Wright, directors; Geo. A. Flagg, secretary and treasurer; James MacNaughton, general manager; Will A. Childs, superintendent; W. M. Gibson, assistant superintendent; J. H. Lathrop, chief clerk; Fred S. Eaton, cashier; E. S. Grierson, chief engineer; E. D. Leavitt, consulting mechanical engineer; Joseph R. Risque, chief mining captain; W. H. Cake, mill superintendent; Jas. B. Cooper, smelter superintendent at Lake Linden; Morris B. Patch, smelter superintendent at Buffalo; Hon. Chas. Smith, chief mill and smelter clerk at Lake Linden works; Geo. M. Kendall, chief smelter clerk at Buffalo works.

Organized 1871, under laws of Michigan, with capitalization $2,500,000, shares $25 par; $12 paid in, and $928 50 per share in dividends paid out to end of 1905. Charter renewed, 1900, for 30 years, and amended, 1905, under new laws of Michigan, making the corporation a securities holding company as well as a mining and smelting company. Is a consolidation of the Hecla, Calumet, Portland and Scott mining companies. Fiscal year ends April 30. Annual meeting is in August. Stock is listed on the Boston Stock Exchange, and traded in on the unlisted department of the New York Stock Exchange. Has paid dividends, to Dec. 31, 1905, of $92,850,000, this being the largest amount ever returned in profits by any incorporated mining company. Dividends for 1905 were $5,000,000. Largest year's dividends were $10,000,000, in 1899. Paid a $15 dividend, March, 1906. Controls three subsidiary corporations, organized 1905, known as the Frontenac Copper Co., Gratiot Mining Co. and Manitou Mining Co. Had a balance of quick assets, for fiscal year 1905, of about $7,000,000.

Official returns to the state of Michigan, as of date Jan. 1, 1905, disclose the following figures:

Amount of cash paid in on capital stock	$ 1,200,000.00
Entire amount invested in real estate	18,961,784.33
Amount of personal estate	7,067,831.52
Amount of floating debt	1,257,271.98
Amount due company	3,041,520.63

Consideration will be given first to the Calumet & Hecla mine proper, which includes about 2,750 acres, lying in a compact tract in Sections 11, 13, 14, 15, 22, 23 and 24, Town 56 North, Range 33 West, Houghton county, Michigan. The company also owns considerable tracts west of the Tamarack mine, carrying the underlay of the Calumet conglomerate; at such stupendous depth that its opening would require a vertical shaft of about two miles in depth. The lands west of the Tamarack were explored, 1904, with diamond drills, in search of a supposed cupriferous conglomerate. The Metalline and Dover tracts, area 200, acres, lying next south of the Tecumseh, were bought 1904. The company also owns extensive tracts of timber land in Michigan and Wisconsin, in addition to the enormous landed holdings of the three subsidiary corporations.

The Calumet & Hecla mine proper is opened on the Calumet conglomerate, which to the north and south has proven unprofitable wherever mined, though the underlay of the lode, opened by vertical shafts, at the Tamarack

mine, has given good returns. The conglomerate has an average strike of N. 39° E., with average dip to the north of west of 37° 30′ with the horizon. The lode has 8′ minimum and 40′ maximum width, with an average of about 12′ to 14′, giving about 2,400 cubic fathoms of stoping ground, equal to circa 43,200 tons of stamp-rock, per acre of area. The Osceola amygdaloid, outcropping 730′ east of the Calumet conglomerate, underlies the entire main tract of the Calumet & Hecla, having a strike parallel to the conglomerate, with an average dip of about 40°. The Kearsarge amygdaloid, which is rich to the northward, also underlies the Calumet & Hecla lands, outcropping some distance east of the Osceola lode. The Calumet amygdaloid, lying between the conglomerate and the Osceola amygdaloid, has been little opened, but might prove payable, if developed, as it shows some rich ground in a crosscut from the 900′ level.

The Calumet & Hecla mine in reality is many mines in one. The Calumet mine at the north, the Hecla in the center and the South Hecla at the south, form one continuous mine developing the Calumet conglomerate by incline shafts, the Red Jacket shaft opening the same lode vertically. The Osceola amygdaloid bed is opened by 5 shafts, and the Kearsarge amygdaloid lode is being opened by three shafts. The mine has 21 shafts, of which 15 are working, 2 are idle and 4 are permanently abandoned. The conglomerate, opened for two miles along its outcrop, has 11 shafts, 8 being single-compartment size, which means single hoisting compartments, two with double compartments, and one vertical shaft with 6 compartments. The 5 Osceola shafts and 3 Kearsarge shafts have double compartments each. The trap and amygdaloid walls of the conglomerate carry considerable copper, especially the foot-wall bed, and much of the adhering trap rock formerly rejected is now milled.

The incline shafts on the conglomerate are worked as two separate mines, known as the Hecla and Calumet branches, the South Hecla being a southerly continuation of the Hecla branch. The shafts on the outcrops are as follows, from north to south: Nos. 6 and 5 Calumet, two compartments each; No. 4 Calumet, one compartment, with a vertical depth of 4,748′ and an actual depth of 8,100′ at an angle of 37° 30′, in addition to which there is a winze of 190′ from the bottom, giving a total depth of 8,290′ from the collar of the shaft to the bottom of the winze; No. 3 Calumet, abandoned; No. 2 Calumet, with one compartment 7,000′ deep and nearing the boundary; No. 1 Calumet, abandoned; No. 1 Hecla abandoned; No. 2 Hecla, 4,400′ deep, bottomed at the Tamarack boundary; No. 3 Hecla, 4,000′ deep, also bottomed at the Tamarack boundary; No. 4 Hecla, abandoned; No. 6 Hecla, one compartment, 6,200′ deep, with ground to sink to 8,500′; Nos. 7 and 8 Hecla, one compartment, 6,300′ deep and can sink to 9,000′; Nos. 9 and 10 Hecla, two compartments, 6,500′ deep and can go to 8,100′; No. 11 Hecla, 2,400′ deep, with poor ground at bottom, and being gutted from the bottom up; No. 12 Hecla, at the company's south line, 6,700′ deep and bottomed in unprofitable ground.

Pillars 75′ wide are left on either side of every shaft, and when the present conglomerate workings are exhausted, down to the Tamarack line, the pillars will give a product equal to about 18% of all the rock mined previously. The

mine is opened for about 8 years in advance of immediate requirements, possibly too far ahead for such soft ground, and has about 200 miles of shafts, drifts, winzes and crosscuts. The quantity of timber used in the mine is about 30,000,000′ annually. Electric pumps are in use on the 48th level of No. 7 Hecla, and elsewhere

As a rule the richer portions of the conglomerate are in the central part of the Calumet & Hecla tract, the most notable exception being in No. 4 Calumet shaft. Nos. 11 and 12, the southermost shafts of the South Hecla, are being gutted, pillars being robbed from the bottom upward. Hecla shafts 6, 7 and 8 show very good ground. To the north of No. 5 Calumet there is a considerable stretch of lean ground, up to the north boundary.

The Calumet & Hecla has suffered severely from underground fires. The amygdaloidal trap rock carrying native metal cannot burn, like copper ore mines rich in sulphur, such as the Anaconda, United Verde, Mountain and others, but the old timbering eventually becomes nearly as inflammable as so much tinder. The really serious mine fires have been five in number, occurring in 1884, in July and November 1887, and on Nov. 30, 1888, and May 27, 1900. All possible precautions are taken against mine fires, these including the partial fire-proofing of all mine timber with chloride of zinc solution, regular sprinkling of all shafts, the maintenance of water-pipes and hydrants, fire-hose, chemical engines, an electric alarm system and 18 telephones at various pump stations, from the 8th to the 51st levels, inclusive, in five different shafts, so distributed as to be most readily accessible from all parts of the mines. From the first four fires the Calumet & Hecla suffered aggregate losses of several millions of dollars, while a number of lives were lost, and three valuable shafts were drawn so badly that they were abandoned. The fifth and latest fire, in May 1900, severely tested the mine's system of fire prevention and extinguishment, the fire breaking out on Sunday evening, when the mine was deserted by all but a few employes, and gaining great headway before it was discovered and the burning portion of the mine shut off by closing the fire-doors. The mine was sealed at surface, by covering the mouths of the shafts with heavy timbers, and tamping dirt tightly into the crevices between. Wherever gas escaped through holes in the earth, dirt was tamped in and luted with water. The fire was extinguished in three weeks, and the South Hecla portion of the mine continued working without interruption. The five serious fires, and sundry smaller blazes nipped in their inception, all have been of mysterious origin, and there are grounds for suspecting incendiarism. Great precautions are taken to prevent unauthorized persons entering the mine, and permission to go underground is given only by the president, in writing, each pass being for one trip only.

The Red Jacket vertical shaft, 4,920′ deep, started 1888, cut the lode at a depth of 3,287′. When first bottomed, the rock temperature in the sump was 87° Fahrenheit (31° Centigrade), but after connection was secured with No. 4 Calumet shaft, the temperature was reduced to between 70° and 80° Fahrenheit, exhaust air from the power drills aiding in cooling the mine. The Red Jacket shaft was designed to open a mine unconnected with the older

workings, in order to give reserve stopes in case of a mine fire, but the heat and danger were so great that connection was made with the older shafts. The conglomerate lode at this point and depth is not up to its usual value, being wide, but below the average content in copper. It is evident, from the results secured by this and the other deep shafts of the district, that while the cupriferous stratified beds may descend to tremendous distances, the copper values grow less at depth. The Red Jacket shaft hoists rock from all the north shafts below the 56th level, at which point the conglomerate is intersected. In the two eastern compartments of this 6-compartment shaft are two 9-ton Kimberley self-dumping skips, swung under the cages. The two western compartments have double-deck cages for men and material, and the two middle compartments have cylindrical steel bailers, which have given good results in freeing the mine of water. Electric turbine pumps were tried experimentally in this shaft, in 1904, with satisfactory results and it is probable that these will displace the boilers for unwatering the mine. By releasing these two compartments for hoisting purposes, the shaft can be given a daily hoisting capacity of better than 4,000 tons of ore. Iron pillars are used extensively, as supports, in portions of the crosscuts connecting the shaft with drifts on the lode, and also in various incline shafts to support the hanging wall. Iron also is used for lagging, to some extent, material being mainly scrap, such as worn-out skip-rails, cut to 10′ lengths and placed above "I" beams. The Red Jacket shaft has 9-ton steel storage-bins at its various productive levels, aiding in maintaining the uninterrupted hoisting service that is absolutely necessary in a mile-deep shaft. The cages are fitted with tail-ropes, these materially modifying the unpleasant and even dangerous vibration formerly noted in the hoisting cables.

The Calumet & Hecla owns 200 acres, known as the "five forties," between the Tamarack and the Tamarack Junior mines. These lands carry the underlay of the conglomerate at great depth, and to obviate sinking a deep and costly vertical shaft, this tract is being opened by a blind shaft, which starts 1,500′ east of the Red Jacket vertical, and near the bottom of Calumet No. 4, which abuts on the Tamarack boundary line at a depth of 8,100′. No. 4 has opened some of the best ground of the entire mine, the lode having an extreme width of nearly 40′, at points, and being notably rich from the 3,600′ to the 4,500′ level. The blind shaft is being sunk 25′ under the footwall, at the same angle as the dip of the conglomerate, thus assuring solidity of walls without necessitating long and expensive crosscuts to the lode on each level. A "footwall drift" on the 57th level parallels the regular drift, at a distance of 25′ in the footwall, between the Red Jacket vertical and the blind shaft, thus obviating the confusion almost certain to result were the regular drifts given double duty. The blind shaft starts from the footwall drift under and parallel with the 57th level, and will be about one mile in depth, opening four of the five 40-acre tracts, leaving the fifth and last to be opened by sub-shafts from the blind shaft. Owing to the regular incline shafts being sunk on the dip of the lode, while the blind shaft must follow the section lines, it descends diagonally on the dip of the lode, giving an average dip of about 22° only, although

ıe lode dips at 37° 30′. This flat incline permits the hoisting of rock in tram-ırs, which are hauled through the blind-drift and dumped in the steel bins the Red Jacket shaft for hoisting, thus saving transfer at the mouth of the lind shaft. The showing in the blind shaft is satisfactory, the lode averaging ′ width, with about 10′ fairly mineralized. The Tamarack Junior mine of ıe Osceola Consolidated, which adjoins the "five forties," is drained by holes ored by a diamond drill from the blind shaft, obviating possible damage y flooding from the abandoned Tamarack Junior workings.

During 1905 the 5-ton skips used in the three of the incline shafts on the onglomerate lode were replaced by 7½-ton skips. The other working hafts probably will have similar skips later, providing a 50% increase in oisting capacity, the engines being amply powerful to meet the increased uty.

It is planned to crosscut eastward to the Osceola and Kearsarge lodes rom the 49th level of No. 2 shaft, which will give the deepest level cross-ection in the district.

Shafts 13, 14, 15, 16 and 17, numbered from south to north, are on the)sceola amygdaloid lode, a cupriferous bed outcropping 730′ east of the 'alumet conglomerate, these beds being practically parallel in strike and nearly arallel in dip. These shafts are of 1,400′ average depth each, and have bout 20 miles of openings on the Osceola bed, with frequent connections, by rosscuts, between the conglomerate and amygdaloid workings. The Osceola hafts were closed 1901, and remained idle until 1904, when No. 13, the outhernmost, was reopened. No. 14 shaft, 3,200′ north of No. 13, was re-pened 1905. A new concrete foundation has been built under the hoist. Jo. 15, 2,600′ north of No. 14, probably will go into commission during 1906. Jo. 16, 1,800′ north of No. 15, went into commission early in 1905, and at the nd of the year was running 22 power drills and stoping about 250 tons daily. Jo. 17, 1,800′ north of 16, is idle, and likely to remain so for some time, as he hoist was removed to No. 21, late in 1905. No. 18 is merely the site for he ultimate northern shaft on the Osceola lode, upon the Calumet & Hecla ract. The laterals in the Osceola workings are carried as drift-stopes, long the hanging wall, to a height of about 12′. With selection the Osceola ock is running about 22 lbs. fine copper per ton.

The Kearsarge lode outcrops about 2,200′ east of the Osceola amygdaloid, ınd 2,930′ east of the Calumet conglomerate, with which beds it is parallel in trike and nearly parallel in dip. The work of permanent development was egun on this bed August, 1903. The Kearsage shafts are numbered from ıorth to south, No. 19 being about 1,000′ south of the north boundary line, and ıt the close of 1905 was 600′ deep, with the first level opened at 180′, and ubsequent levels at intervals of 110′. The openings are somewhat erratic, ut fairly satisfactory, showing good stamp-rock, carrying probably 18 o 22 lbs. fine copper per ton, with reasonable selection. This shaft is a new leparture in Lake mining practice, being "timbered" with steel, brick and oncrete. The shaft has 3 compartments, 2 for hoists, and the hanging wall s lined with 3 arches of brick, laid in 3 to 5 courses, thickness being increased

with depth, supported by two rows of steel "I" beams, serving also as dividers for the shaft.

No. 20 shaft, 2,400′ south of No. 19, and similarly "timbered", was about 500′ deep at the close of 1905.

No. 21, 8,000′ south of No. 20, was but fairly started at the close of 1905. Considerable difficulty was experienced in locating the southern extension of the Kearsarge lode for this shaft, a drift from the temporary exploring shaft being sent in the wrong direction. Dr. A. C. Lane, state geologist, was called into consultation, and, by following his advice, the Kearsarge amygdaloid bed was located in a few hours—a very considerable triumph for the believers in scientific geology. The shaft is constructed similarly to Nos. 19 and 20, and, at shallow depth, shows well in copper. A permanent hoist, taken from No. 17 and good for one-half mile depth, was installed late in 1905. Results at the Kearsarge shafts were somewhat indifferent, until late in 1905, when an improvement was noted in both Nos. 19 and 20. About 15 drills are employed in the Kearsarge shafts, and small rock shipments are made, mainly for test purposes. The Kearsarge shafts have permanent equipments, with railroad tracks, and are connected with the compressed air mains of the company's system.

The shaft-rockhouses at the conglomerate incline shafts are of uniform pattern. At each the rock is hoisted to the top of the shafthouse, passing thence over grizzlies that allow the finer rock to fall through, the larger masses being reduced in 24x36″ jaw crushers, and going to 18x24″ crushers on the floor beneath. The crushed rock falls by gravity into storage bins, whence it is dumped into hopper-cars that take it to the mills, railroad tracks running underneath each rockhouse.

The electrification of the mine was begun, March, 1906, when electric motors were installed in the rockhouse at No. 2 Calumet shaft. At the Red Jacket vertical shaft the collar has been enclosed and a ventilating chimney added, doing away with the ice formerly resulting in winter from the steam arising from the mine.

The surface equipment of Calumet & Hecla is the most complete owned by any mine. With rare exceptions, everything is duplicated, to prevent possible delays or suspension through fire or accident. The carpenter shops are of great size and fitted with every modern wood-working appliance. The smithies are larger than may be found elsewhere outside, of the works of a few of the very largest machinery manufacturers, and are supplied with steam-hammers, forges, blowers, emery-wheels, grindstones, etc. The Calumet smith shop sharpens upwards of fifty tons of steel drills daily, requiring the services of a small regiment of drill boys for transport between the shops and mines, while forging and general blacksmithing are done at the Hecla shops, to which a stone addition of 56x152′ was built in 1903. Upwards of one hundred blacksmiths are employed in the various shops. The machine shop, 225x250′, is very complete in equipment, turning out an immense variety and quantity of work. The company has a very large brick warehouse, for general supplies, and special warehouses for steel and iron, paints,

a three-story steel annex, 65x78′ on the ground and 94′ high. The old wheelhouses are of wood, iron-sheathed. The steel in the annex to the Hecla wheelhouse weighs 490 tons, and the building is equipped with a 45-ton Sellers traveling crane. The sand wheel is to appearance a gigantic bicycle wheel, fitted with a spur gearing where the rubber tire should be. The complete wheel weighs 500 tons, and is mounted upon massive concrete masonry. Four 25-ton iron bed-plates support the pillars carrying the 21-ton Krupp forged steel axle, which is 27′ long and 32″ in diameter with a hollow core of 26″ diameter. Radiating from axle to rim are 2″ steel spokes 32′ long. The rim is in 20 segments weighing 10,700 lbs. each, the inner perimeter of the wheel having 550 buckets, in pairs, each 3′ wide and 4′ 6″ long, and holding 100 gallons, giving the wheel a capacity of 55,000 gallons per revolution. The completed wheel is 10′ wide and 64′ in diameter, driven by gear and pinion, power being furnished by a 700-h. p. dynamo. Nearly two years were required to build and adjust this monstrous wheel.

The boiler plant at the mills has 22 boilers, of which an average of 14 are kept under steam. There are four 250-h. p. boilers, thirteen 300-h. p. boilers and five 500-h. p. boilers, giving a total steaming capacity of 7,400 horse power. Daily coal consumption averages 240 tons at the stamp-mill power plant. The combination boiler-house and smithy, 50x100′, is of steel. The boilers at the mill consume about 500,000 gallons of water daily, secured from a reservoir, artesian wells and Torch Lake. Trouble from impure water has been solved by the installation of a Jewell filtration plant, of 500,000 gallons daily capacity, in which the impurities originally found in the water are precipitated by lime.

Miscellaneous buildings at the millsite include a 48x175′ warehouse, machine shop, carpenter shop, paint shop and sundry smaller buildings.

It was decided, in 1904, to substitute electric energy for steam power, wherever practicable. In the case of some of the big compounded hoists, the change would be of doubtful economy, as well as necessitating enormous initial outlays, but in the case of much of the machinery electricity will effect large savings in operating costs. The central power station is located at Lake Linden, near the mills, a 120′ steel addition being built to the old electric building of 45x85′ with a 45x60′ wing. This originally had two engines, the "Saginaw" and "Gratiot," the latter connected with the generator by rope belting. The "Saginaw" is an Allis-Chalmers twin vertical tandem compound-expansion direct-connected engine, having cylinders 17x40x48″, with a speed of 95 revolutions per minute. Each engine drives a 1,000-kilowatt alternating current generator, furnishing energy for the new Hecla sand-wheel, new Hecla mill, electric lights and sundry other uses. Work on the new building was begun 1904, the structure was completed 1905, and power from the new plant will be available at mines, mills and smelter in the summer of 1906, poles having been set and a transformer house built at the mine in 1905. The advantage of locating the central power plant at Lake Linden is that coal can be delived alongside, from the largest vessels plying the great lakes, effecting a saving of

boiler-house has 10 boilers and a 250′ smokestack of 12′ 6″ internal diameter.

The engine-house serving shafts 9 and 10, South Hecla, contains the engines "Detroit" and "Onota," of 1,000 h. p. each, and the engine-house at shafts 11 and 12 has Lidgerwood hoists of similar capacity.

The Red Jacket shaft has an 8,000-h. p. quadruple hoist, housed in a 70x220′ brownstone building, and in an adjoining brownstone building, of 70x150′, with a 250′ smokestack of 12′ 6″ inside diameter, are ten 1,000-h. p. boilers. At the rear of the engine-house is a 32x412′ brownstone annex, floored with cement and roofed with slate, in which is carried the fleet-gear. In raising ten-ton loads perpendicularly from a depth of one mile, the weight of the cage and steel cable nearly equals that of the cargo of rock, but with the aid of counterbalance the engines can hoist ten-ton loads at a speed of 40 miles per hour, the regular hoisting time being about 90 seconds for the vertical distance of nearly a mile, this including time taken for starting and stopping, an achievement no locomotive could duplicate on a horizontal plane. The engine operates on the well-known Whiting system, devised by S. B. Whiting, formerly general manager of the company. To overcome the dangerous strain caused by unequal wearing, Walker differential rings have been placed on the sheaves, with excellent results, the cables taking 4 complete turns around the driving sheaves. The Red Jacket steel combination shaft-rockhouse, 100′ square and 110′ high, is fitted with breakers capable of crushing 2,000 tons of rock daily.

The engine-houses on the Osceola lode have steam and air connections, and the Kearsarge shafts have air connections with the main power plants at the conglomerate shafts. Shafts Nos. 13, 14 and 15 have powerful permanent hoists, while No. 16 has a temporary hoist only. Shafts 13, 14 and 15 have large stone engine-houses, while 16 and 17 have temporary engine-houses only. The Osceola shafts are supplied with permanent shaft-rock-houses, of the standard Calumet & Hecla size and equipment.

Among miscellaneous surface improvements at the mine is a 74x74′ stone building housing the electric power and lighting plant, a timber-mill that mortises and tenons the bed-pieces, legs and stulls of the square sets used underground, a large paint-shop, oilhouses, barns, etc., and a private telephone exchange with 100 instruments.

The Calumet & Hecla owns about 1,200 houses, occupied by employes at an average rental of 6% interest on actual cost, plus cost of maintenance, and about 1,200 dwellings are owned by employes, on lands leased from the company, at low yearly rentals. The company also maintains a large hotel and a fine stone clubhouse for employes, the latter containing bath-rooms, bowling alleys, etc. A free library of more than 16,000 volumes contains books printed in a score of languages, 30 different nationalities being represented on the company's payroll. There also is a combination library and clubhouse, at Lake Linden, for stamp-mill and smelter employes. There are some 30 churches on Calumet & Hecla lands, occupied by a dozen different denominations, and for all these churches sites were donated, and in most cases substantial aid has been given in their erection and maintenance, en-

plant has an 85-kw. generator, with a 25-kw. generator in reserve, as an auxiliary.

The two-story assay office and laboratory, 40x42′, with a 14x14′ wing, is exceptionally well arranged and complete in equipment. There also is a large warehouse and an office building at the smelting plant.

The eastern reduction plant, at Black Rock, Buffalo, N. Y., is known as the Buffallo Smelting Works.. It is located on the Niagara river, with deep water in front and direct rail connections in the yards. The plant is well arranged, but has grown to nearly the capacity of its site, and soon will need more room. A 30-ton electrolytic refinery, originally installed partly for experimental purposes, has grown to large size, and now treats a considerable proportion of the Calumet & Hecla copper. Formerly the high-grade mineral was shipped to the Buffalo works for smelting, but at present all grades of mineral are treated at both plants. The deeper workings of the Calumet & Hecla yield arsenical copper, and this requires electrolytic refining, by means of which considerable silver, formerly lost, is now saved.

The Buffalo works, which employ about 150 men, include reverberatory and blast-furnace buildings, electrolytic plant, two large mineral-houses, office, laboratory and coal-hoists. Sufficient mineral is shipped to the Buffalo works, during the open season of navigation, to keep the plant operating steadily from December till May, while lake navigation is closed. The Calumet & Hecla operates a fleet of steel steamers and barges, for carrying mineral east and bringing coal cargoes back to the mines in return, the fine steel steamer, Geo. A. Flagg, of 5,300 tons register, being of this fleet.

The dock system of the Calumet & Hecla is extensive, and includes a series of very large coal-sheds at Lake Linden, with one of 200,000 tons capacity, the old sheds being of wood and the new of steel. There is a series of docks at the mills and smelts on Torch Lake, all with substantial wharves having at least 21′ of clear water alongside, frequent dredging being required to maintain this depth of clear water, owing to stamp-sand filling in. The wharves were extended, 1904-1905, both at Lake Linden and Hubbell. The 750′ coal wharf has 11 Hunt hoists and three 52′ movable derricks, one of wood and two of iron. The Calumet & Hecla owns and operates the ship-canal connecting Torch Lake with the government waterways on Portage Lake, this canal being 21′ deep and accommodating the largest vessels plying the great lakes. Tolls, ranging from 10 cents on soft coal to 50 cents per ton on package freight, are charged by the company, on independent cargoes entering Torch Lake through this canal.

A sawmill, at the head of Torch Lake, receives logs by raft and ships sawed lumber and timber by a branch of the company's railroad. At the mouth of the Sheldrake river, on Whitefish Point, Chippewa county, Michigan, the company has a mill sawing about 12,000,000 feet of lumber yearly, with about 8 years' supply of standing timber tributary thereto. The company also has a mill at Ashland, Wisconsin, and owns extensive tracts of pine, hemlock and hardwood at various points along the southern shore of Lake Superior, in addition to which much timber is bought of jobbers, the company's re-

quirements for underground timbering alone being about 30,000,000' annually, in addition to the many millions of feet of timber and lumber used on surface, at the mines, mills and smelters.

Within the past five years the policy of the Calumet & Hecla has been greatly changed. Almost from its birth the mine was the greatest copper producer of the world, and the most profitable mine of any metal. The company was progressive, and led the van in the introduction of heavy mining machinery, and in many other respects, but, with all its progressiveness, the management fell into a rut. This fact finally became apparent to the directorate, and with the new century came a new policy—one that has worked wonders in five years, and will work greater wonders in the years to come. The Calumet & Hecla mine proper had at least thirty years of life remaining, and could have continued to earn four to eight million dollars annually for that period, but it was felt that the future must be assured, and that so magnificent a corporation be not permitted to wind itself up by the exhaustion of its original mine. For five years the energies of the company have been bent upon betterments in every department, and upon the development of new mines to replace the old. A quarter century is a long time to look ahead, but this is what the officials of this company are doing, and have been doing for the past five years, and it is this unusual foresight that stamps the management as one of most unusual ability.

There is glory enough for all connected with the mine in the achievements of the past five years, and there are few in positions of responsibility who are not entitled to credit, but the praise must be given mainly to Col. Livermore and Mr. MacNaughton. The result of their labors, while plainly perceptible to close observers for two years past, is just becoming apparent to the world at large, the first public declaration of the new Calumet & Hecla being found in the magnificent production of 1905, which not only was the largest in the history of the mine, but raised it from fourth place, in 1903, to first place, in 1905, among the copper producers of the world.

With so large a concern as the Calumet & Hecla, employing thousands of men, earning annual profits of millions of dollars, and representing an investment of scores of millions, growth must be along carefully considered lines, to be effective. There has been growth during the past five years, and it has been well-balanced, affecting every department of the company. The mining plant has been brought to a higher degree of efficiency, new mines are being opened parallel with the old mine, the stampmills have been rebuilt, one section at a time, improvements have been made in the smelters, upon the railroad and in the wharves. Timber supplies for the far future have been looked to, and the electrification of the mine provided for. Operating costs per ton of product have been largely reduced, without cutting wages, and while charging millions direct thereto for new equipment. Despite decreased percentage of copper, due to deepened mines, the cost of making a pound of copper has been reduced from almost 11 cents, in 1901, to about 7 cents, in 1905.

The achievements that have been merely enumerated by heads, in the foregoing paragraph, would be ample glory, but even greater things have been

done. The Calumet & Hecla has branched out in every direction, in the Lake Superior copper belt. It has acquired tens of thousands of acres of mineral lands, in the three counties of Houghton, Ontonagon and Keweenaw. This has been done skilfully, at very reasonable cost, and with a remarkable absence of publicity, considering the watchfulness with which maneuvers of so great a corporation are regarded by thousands of curious, keen and frequently jealous eyes. The delicate work of examination and negotiation has been greatly facilitated by the esprit du corps and loyalty which are such notable features of the Calumet & Hecla force.

By a change made in the Michigan laws, in 1905, the Calumet & Hecla was enabled to modify its charter, and is allowed to hold stock in other corporations. This has permitted the Calumet & Hecla Mining Company to secure control of other mines and mineral tracts, in two ways, one being the organization of subsidiary companies controlled or owned outright, while the second plan permits the securing of control by purchase of majority interests in promising new properties that require money for development purposes. The company now controls three directly subsidiary corporations, these being the Frontenac Copper Co., Gratiot Mining Co. and Manitou Mining Co. The two first named companies are owned outright, except necessary founders' shares, and the Manitou is owned except a 10 per cent. interest. A controlling interest, to the extent of 51%, is held in the Superior Copper Co., which is opening a promising mine on the northern extension of the Baltic lode, near Houghton, under an option expiring Sept. 1, 1906, which may be extended to the end of the year, and negotiations are under way for similar arrangements with other new companies. The Manitou is opening a very promising mine on the old Delaware property. All of the subsidiary corporations will be found described, under their respective titles. Through the Frontenac, Gratiot and Manitou companies, the Calumet & Hecla has secured control, in Keweenaw county alone, of about one hundred square miles of mineral lands, and in addition has bought numerous other mining properties in Houghton county, and is supposed to have secured control of the Nonesuch mine in Ontonagon county. The earnings of the Calumet & Hecla are so large that the company can, with ease, set aside a million dollars or more yearly, for exploratory and development work on these new lands, while maintaining regular dividends. The economies effected in five years, at the Calumet & Hecla proper, would provide the million dollars yearly, and leave twice as much for the shareholders.

Detailed figures of production and dividends by years will be found in the statistical chapter. The statistical confusion so frequently noted in figures of Calumet & Hecla production is caused by the use of four sets of figures of production of refined copper, to say nothing of two sets of figures of output of crude mineral (unsmelted copper), and numerous estimates of more or less authenticity. The four sets of official figures of annual production are for actual output of refined copper, and also quantity of fine copper contained in mineral produced, for the calendar year, and also for the company's fiscal year. Figures used in this publication are those of actual outputs in refined copper

by calendar years. At the close of 1905 rock production was at the rate of about 6,600 tons daily, of which about 6,000 tons came from the conglomerate, about 500 tons from the Osceola amygdaloid workings, and about 100 tons from the shafts on the Kearsarge amygdaloid. The completion of the final section of the mills will add about 20% to the milling capacity, and improvements at the mine will permit a daily production of at least 7,500 tons, and possibly as much as 9,000 tons daily, an increase of 25% to 50% on the tonnage of 1904. The increased ore production is reflected by the greatly increased output of fine copper, which was 95,100,610 lbs. in 1905, as against 80,341,019 lbs. in 1904. For 1906 the output of fine copper should exceed one hundred million pounds, for the first time in the history of the mine, leaving the Anaconda the only competitor for the first place among the world's copper mines, while for 1907 a further increase should be shown, with every likelihood of steady growth in future years.

To those who have read the foregoing description of the Calumet & Hecla, no word of commendation of mine or management will be required. The facts carry their own eulogy.

CALUMET, HECLA & MUSCATINE MINING CO.

Office: Cass Avenue and Second St., St. Louis, Mo.

CALUMET MINING CO. **COLORADO.**

Office: 2 Toltec Bldg., Denver, Colo. Letter returned unclaimed from former mine office, Rollinsville, Boulder Co., Colo. Emerson J. Short, president and general manager. Main shaft, 100′, is said to show a 2′ paystreak of auriferous and argentiferous chalcocite assaying 25% to 40% copper.

CALUMET MINING, MILLING & SMELTING CO. **COLORADO & WYOMING.**

Mine offices: Montezuma, Summit Co., Colo., and Encampment, Carbon Co., Wyo. T. H. Andrew, president; Prof. E. O. Perisho, vice-president; O. L. Andrew, second vice-president and secretary; Ernest Foster, consulting engineer. Capitalization $500,000, shares $1 par. Lands, 3 claims, area circa 50 acres, adjoining the Charter Oak, with about 200′ of shafts and open-cuts. Also owns the Waterloo group, in Summit county, Colorado, which has produced high-grade silver-lead ores in the past, and is claimed to have $75,000 worth of ore, running $35 to $150 per ton, blocked out for stoping. Apparently the copper claims, in Wyoming, are idle.

CALUMET & MONTANA DEVELOPMENT CO. **MONTANA.**

Dead. Former office was at Calumet, Michigan.

CALUMET & MONTANA MINING CO. **MONTANA.**

Office: care of Chas. Chynoweth, secretary, Calumet, Mich. John Daniell and Paul P. Roehm, directors; Fred Reuther, consulting engineer. Capitalization $300,000, shares $1 par. Lands, 6 claims, area 120 acres, in Beaverhead county, Montana, located in the Copper Queen district, near the Idaho line. Mine has tunnels of 125′ and 160′, showing a 5′ fissure vein carrying auriferous and argentiferous chalcocite and bornite. A test shipment, to Salt Lake, gave smelter returns of 18% copper, $4 silver and $66 gold per ton. Company has purchased and will install boilers, air-compressor

and power drills, and expects to begin ore shipments early in the summer of 1906. Management is good and property considered promising.

CALUMET & ONTARIO DEVELOPMENT CO. **ONTARIO.**

Office: Calumet, Mich. Mine office: Massey Station, Algoma, Ontario. Lands are sundry copper claims near the Hermina mine. Idle.

CALUMET & OREGON MINING CO.

Organized, 1905, under laws of Maine.

CALUMET & PINAL MINING CO. **ARIZONA.**

Mine office: Red Rock, Pinal Co., Arizona. Mott Guild, manager. Lands, sundry claims in the Owl Head Mountain range, 18 miles northeast of Red Rock, opened 1879, which produced about $35,000 in ore values, when worked by chloriders, in the past. Is sinking a shaft and plans installing steam power.

CALUMET & PITTSBURG DEVELOPMENT CO. **ARIZONA.**

Reorganized, December, 1903, as Calumet & Pittsburg Mining Co.

CALUMET & PITTSBURG MINING CO. **ARIZONA.**

Office: Calumet, Mich. Mine office: Bisbee, Cochise Co., Arizona. Chas. Briggs, president; James Hoatson, vice-president; Thomas Hoatson, 2d vice-president; Louis W. Powell, 3d vice-president and general manager; Gordon R. Campbell, secretary; Peter Ruppe, treasurer; preceding officers, Thos. F. Cole, Chas. d'Autremont, Jr., Chester A. Congdon and Geo. E. Tener, directors; Henry B. Paull, auditor. Employs 150 men. Organized December, 1903, as successor of the Calumet & Pittsburg Development Co., with capitalization $2,500,000, shares $10 par, full paid and all issued, 50,000 shares in the treasury having been issued pro rata among shareholders at par, 1905. Annual meeting, second Monday in April.

Lands, 21 patented claims, area 325 acres, adjoining the Copper Queen, Calumet & Arizona, Lake Superior & Pittsburg, Pittsburg & Duluth and Junction mines, with which four last-named companies the Calumet & Pittsburg is closely affiliated, having the same officers and with which three last-named companies it is proposed to amalgamate in 1906. Cost of lands was $937,451.75, paid in cash. Ended 1905 with a cash balance of $108,408.71. Development is by two shafts. The 4-compartment Briggs shaft, 1,159′ deep, lies about 3,000′ south of the Junction shaft and about 3,000′ east of the Lowell shaft of the Copper Queen, both of which shafts are drained by the Briggs, which is very wet, entailing costly pumping. In September, 1905, this shaft was forking out nearly 5,000 gallons per minute. The first level, at 910′, shows 600′ of leached ore and soft material, of the sort which has been found capping the big ore bodies of adjoining mines, and this drift has cut the tops of 3 ore bodies of 5′ to 17′ width, carrying 10% to 20% ore. A 200′ diamond drill hole has penetrated considerable high-grade ore, and a winze on this level, east of the Briggs shaft, is sinking in soft leached ore. A plat was cut for the 1,150′ level, February 1, 1906, and it is expected that the drifts on this level will develop workable ore bodies. The shaft has an 8″ air-line and two 12″ water-columns. The shaft has three pumps, of which 2 are Prescotts. On surface is a steel gallows-frame and a power-plant

with 7 boilers, of which 5 are of 250 h. p. each, burning crude petroleum. There also is an 18-drill air-compressor.

The 4-compartment Hoatson shaft, on the Del Norte claim, about 2,500′ from the Briggs shaft, was 1,180′ deep on May 1, 1906. This was sunk 162′ in December, 1905, which is the camp record for rapid sinking, and possibly a world's record as well. This shaft will begin drifting at 1,150′ and practically is assured of good ore, developments in the Lowell shaft of the Queen being favorable up to the Del Norte boundary line. The Lowell shaft is draining much of the water in this district, but the Hoatson is liable to catch both water and ore at a little greater depth, the shaft being bottomed in very promising material. Equipment includes a 50′ gallows-frame and a double-drum hoist, good for 1,500′, brought from the Junction shaft.

The Junction shaft is sunk on the boundary line of the Calumet & Pittsburg and Junction mines, to develop both, and a drift from this shaft on the 900′ level enters the Ormond claim of the Calumet & Pittsburg, with a promising showing of leached ore.

The management of this company is excellent, and while developments to date have failed to open the big ore bodies confidently expected, the showing remains encouraging, at the different points of attack.

CALUMET & SAULT STE MARIE DEVELOPMENT CO. **ONTARIO.**

Office: Calumet, Mich. Letter returned unclaimed from former mine office, Massey Station, Algoma Ontario. Fred. Roehm, president; Wm. F. Ashton, superintendent. Lands, sundry claims, near the Hermina, opened by a 100′ main shaft, said to show a 14′ vein carrying auriferous chalcopyrite.

CALUMET & SONORA MINING CO. **MEXICO.**

Office: 610 First National Bank Bldg., Duluth, Minn. Mine office: La Cananea, Sonora, Mexico. J. E. Cooley, president; Marcus L. Fay, vice-president; Hubert V. Eva, secretary; Chas. W. Ericson, treasurer; Jas. A. Daugherty, superintendent. Organized 1902, under laws of Minnesota, with capitalization $300,000, shares $10 par. Lands, 70 pertenencias, area 173 acres, in three adjoining groups, nearest about 5 miles from La Cananea, slightly developed by shafts of 50′, 65′ and 193′, and a 90′ tunnel. Country rocks are mainly limestone and porphyry, with promising copper outcrops. Main shaft shows good copper-silver ore, but is very wet. Idle at last accounts, but company plans resuming work in spring or summer 1906.

CALUMET & TEXAS MINING CO. **TEXAS.**

Office: Cedar Rapids, Iowa. Mine office: Carlsbad, N. M. John H. Shary, president and general manager; Wm. Fullerton, secretary; Alfred C. Sieboth, consulting engineer. Organized, May, 1901, under laws of New Mexico, with capitalization $250,000, shares $1 par. Lands, 36 claims, area 720 acres, also 640 acres of oil lands, in the Guadalupe Mountains, El Paso county, Texas, showing an ore body giving assays of 20% copper, 5% lead and 1 oz. silver per ton, with a trace of gold, from carbonate ores, opened by tunnels of 40′, 200′, 210′ and 328′. Nearest railroad, the Pecos

Valley & Northeastern, is 64 miles distant. Test shipments of 23 tons of ore sent to the El Paso smelter, gave returns of 19% to 24% copper. Idle.

CALUMET & WESTERN DEVELOPMENT & MINING CO.

Office: 400 Fifth St., Calumet, Mich. F. S. Carlton, president; John Daniell, secretary; W. B. Anderson, treasurer. Organized 1903, under laws of Arizona, with capitalization $6,000,000, shares $10 par, in 100,000 shares of 7% preferred stock and 500,000 shares of common stock. Present holdings include the Globe zinc mine, near Joplin, Missouri.

CALUMET & YAQUI RIVER COPPER CO. **MEXICO.**

Office and mine: La Cananea, Sonora, Mexico. H. C. Rolfe, president; Geo. H. Nolte, secretary; W. J. Elliott, treasurer. Organized April 28, 1903, under laws of Arizona, with capitalization $3,000,000, shares $10 par. Apparently is the same as Santa Marguerite Mining Co., and is supposed to have purchased the mines of the Venice Copper Co., area 85 pertenencias, 7 miles from Soyopa, Sonora, Mexico. The Venice property was alleged to have possessed a 50-ton smelter, and to be opened by a 1,200′ tunnel, showing good copper ores.

MINA CAL VERDE. **MEXICO.**

Office: care of Chas. A. Green, owner, Mill City, Nev. Lands, 17 pertenencias, in the Sierra de los Arrados, district of Bravos, Chihuahua, Mexico, showing limestone impregnated with copper stains, carbonates and oxides, traversed by a porphyry dike, with a heavy iron capping. Idle.

MINA CAMAQUAN. **BRAZIL.**

Mine office: Camaquan, Rio do Sul, Brazil. Was said, 1905, by Bureau of American Republics, to be yielding 30% copper ore.

CAMBRIAN CONSOLIDATED MINES, LTD. **WALES.**

Wound up, September, 1904.

CAMBRIAN COPPER MINING CO., LTD. **WALES.**

Voluntarily wound up, February, 1903.

CAMBRIAN MINING & MILLING CO. **CALIFORNIA.**

Mine office: Placerville, El Dorado Co., Cal. F. Thomas, president; Leonard Thomas, general manager; D. R. Roberts, superintendent. Organized 1898. Mine, originally opened, circa 1855, for gold, has 3 parallel veins, averaging 6′ to 8′ width, with gangue of talcose schist and lime, between diorite and serpentine, showing cuprite, malachite and sulphide ores, with native copper in the alteration zone, ores carrying 8% to 16% copper and good gold values. Has 3 tunnels and a quarter mile of drifts.

CAMBRIDGE COPPER MINING CO. **NORTH CAROLINA.**

Dead. Formerly had a mine near Jamestown, Guilford Co., N. C.

CAMERON MINES. **ARIZONA.**

Sold, 1902, to Canyon Copper Co.

MINAS DE CAMPANARIO. **SPAIN.**

Office: care of Don Antonio Guijarro Orta, Huelva, Spain. Mine office: Valverde del Camino, Huelva, Spain. Lands are a group of 6 properties, area 87 hectareas, on which iron-copper sulphides were being developed, at last accounts.

CAMP BIRD EXTENSION MINING CO. **COLORADO.**

Office: 302 Boston Bldg., Denver, Colo. Mine office: Ouray, Ouray Co., Colo. F. L. Siegel, president; F. J. Campbell, secretary, treasurer and manager; M. L. Thistle, superintendent. Has water and electric power. Mine idle, and company likely to lose property, unless additional funds are secured.

SOCIEDAD ANONIMA COBRES DE CAMPÓO. **SPAIN.**

Office: Santander, Spain. Mine office: De Soto, Santander, Spain. Don Alberto Gutiérrez, president; Don Luis Torres Quevedo, secretary. Property is a group of idle copper mines.

CAMPRODEN COPPER SYNDICATE, LTD. **SPAIN.**

Offices: 3, Lord St., Liverpool, Eng. Moribund.

CAMPERDOWN GROUP. **WYOMING.**

Mine office: Saratoga, Carbon Co., Wyo. Lands, sundry claims, north of the Cumberland group, on the southern slope of Coad Mountain. Is said to have a good showing of copper ore, somewhat resembling that of the Cumberland group.

CAMP VERA GROUP. **CALIFORNIA.**

Lands are in the Morrow district of San Bernardino county, California. Letter addressed to J. W. Rodgers, owner, Barstow, Cal., returned unclaimed.

CANADIAN-AMERICAN MINING CO. **BRITISH COLUMBIA.**

Lands, sundry claims, on Gribble Island, off the coast of British Columbia. Idle.

CANADIAN CONSOLIDATED MINES, LTD. **BRITISH COLUMBIA.**

Title changed, 1906, through supplementary letters patent, to Consolidated Mining & Smelting Co. of Canada, Ltd.

CANADIAN COPPER CO. **ONTARIO.**

Office: 43 Exchange Place, New York. Mine office: Sudbury, Algoma, Ont. A. P. Turner, president and general manager; John Lawson, superintendent; David Browne, smelter superintendent. This is the world's largest producer of nickel, and is controlled by the International Nickel Co., through ownership of nearly the entire stock issue. The property was discovered in 1882 and opened in 1886. Lands are extensive, including the Creighton mine, worked open-cast, now the largest producer, the Stobie mine, in Blezard Twp., 4 miles north of Sudbury, the Evans, McArthur 1 and 2, McDonald, Clara Belle A and B, and other mines, in addition to the older and principal workings at Copper Cliff, the Copper Cliff mine being opened to the 14th level. Ore is nickeliferous chalcopyrite, with pyrrhotite gangue, occuring as irregular lenses in basic igneous rocks, mainly greenstone and diorite. Ore is heap-roasted at the Copper Cliff mine, and matted at the Sudbury smelter, 3 miles distant. The roast-heaps contain 4,000 to 5,000 tons each, roasting requiring three to four months. Latterly a considerable proportion of green ore is mixed with the roasted ore, in smelter charges. The first fusion product is a matte of 30% to 35% tenor in combined nickel and copper, the second fusion giving an 80% matte, which is shipped to the Orford works, at Constable Hook, N. J., and smelted with sulphite of soda,

by which the separation of the nickel and copper is effected, the resultant copper product being refined electrolytically. The ore gives average returns of about 2.75% copper and 5.5% nickel.

The new smelter, of brick and steel throughout, has storage bins of 2,000 tons capacity, material being handled from mines to smelter, and at the latter, by two 80-ton locomotives, hauling 50-ton drop-bottom dump-cars. The new smelter has two furnaces of 500 tons capacity and a converter plant, power being almost exclusively electric, generated by a central steam plant, to be replaced by electricity. The Huronian Company, a subsidiary corporation, is completing a powerful electric installation at High Falls, on the Spanish river, 4 miles north of the Canadian Pacific Railway, with dams estimated to impound water sufficient to generate 11,000 horse power, which installation eventually is to be doubled.

In smelting, the company's new plant has taken many ideas from the Tennessee Copper Co. and the Mond Nickel Co. The use of mixed charges of raw and roasted ore is a modification of the new Tennessee process, while the Mond process is utilized in bessemerizing the matte carrying about 80% of combined nickel and copper. In addition to treating ores from its own mines, the company does a custom smelting business. The new reduction works include a 100-ton arsenic plant, with condensation chambers for crystallization of the arsenical fumes. The new plant is treating auriferous mispickel, bought from the Big Dan and Leckie mines, in the Nett Lake district, paying therefor 95% of the assay values in gold, 35c. per lb. for cobalt, 12c. per lb. for nickel and 1c. per lb. for arsenic. Production 1905, was 4,743 short tons nickel, valued at $1,516,747, a falling off of 2,255 tons from 1903, and 4,326,000 lbs. fine copper, as against 8,010,000 lbs. in 1903. The production, which has been below normal for 2 years, should show a large gain in 1906.

CANADIAN MINING & DEVELOPMENT CO. **MONTANA.**

Letter returned unclaimed from former mine office, Basin, Jefferson Co., Mont. Lands, 10 claims, showing gold, silver, lead and copper ores.

CANADIAN NICKEL CO. **ONTARIO.**

Letter returned unclaimed from alleged works office, Sault Ste Marie, Algoma, Ont. Was said to have leased the reduction plant of the Lake Superior Corporation, and plans refining nickel and copper by a new electric process.

CANADIAN SMELTING WORKS. **BRITISH COLUMBIA.**

Works office: Trail, Yale district, B. C. W. H. Aldridge, general manager; Jules Labarthe, superintendent. Is owned and operated by the Consolidated Mining & Smelting Co. of Canada, Ltd. Is the largest lead-copper reduction plant in Canada, with 1,200 tons daily capacity, and employs 350 men. Power is furnished by electric current, brought about 30 miles from the Kootenay river, a line current of 20,000 volts being stepped down to 550 volts at the smelter, giving a total of 1,000 h. p. in motors, divided into 16 units. The plant treats custom ores extensively, these coming mainly from Rossland. Plant includes a 100-ton Gates crusher, 3 Vezin automatic samplers, Jones riffle sampler, 24 roast-stalls, 19 calciners

and three 300-ton copper furnaces, with automatic feed. Ore and fluxes are handled in hopper-cars, drawn by 10-h. p. electric locomotives. The first fusion matte contains 10% to 12% copper only, which is granulated and roasted in two O'Hara furnaces, after which the calcined matte is briquetted and resmelted to a second matte averaging 50% in copper tenor. The final product is blister copper. The works include a very complete lead-smelting plant, handling silver-lead-zinc ores, equipped with an electrolytic lead refinery, the first ever built. During 1905 the works treated 240,000 tons of ore, producing therefrom 4,571,764 lbs. fine copper, 13,382,050 lbs. lead, 1,359,911 oz. silver and 82,644 oz. gold, with a total value of $3,475,747.29, and also refined $320,000 worth of bullion from other works. Plant is well equipped, and smelting and refining practice are modern and efficient.

CANANEA CONSOLIDATED COPPER CO., S. A. **MEXICO.**

Office and mine: La Cananea, Sonora, Mex. This company, incorporated under Mexican laws, holds direct title to the mines of the Greene Consolidated Copper Co., the Greene company owning the entire stock issue of the Cananea Consolidated.

CANANEA & DULUTH DEVELOPMENT CO. **MEXICO.**

Organized May, 1905, with capitalization $400,000, shares $10 par. Apparently was succeeded, circa 1906, by Cananea-Duluth Mining Co.

CANANEA-DULUTH MINING CO. **MEXICO.**

Office: Hibbing, Minn. Mine office: La Cananea, Sonora, Mex. Geo. McMillan, president; Walter J. Power, vice-president and general manager; S. L. Proctor, treasurer. Capitalization $500,000, shares $1 par. Property is entirely paid for and company was out of debt, in spring of 1906. Lands, 50 pertenencias, lying about 1,000′ east of the Cobre Grande shaft of the Greene Consolidated, extension of vein of which is supposed to be carried. Property is known as the Dos Naciones, and is being developed by 2 shafts, of which No. 1 shows low to medium grade ore on the 100′ level, toward the American property. The claims have not been sufficiently developed to pass upon their value, but indications are of a favorable nature.

CANANEA & EASTERN MINING CO. **MEXICO.**

Office and mine: La Cananea, Sonora, Mex. J. J. Williams, president; E. P. Draper, secretary; M. J. Thomas, treasurer: L. P. Nash, superintendent. Organized September 9, 1904, under laws of Arizona, with capitalization $1,000,000, shares $1 par. Mexican corporation is the Cananea Eastern Mining Co., S. A. Lands, 149 pertenencias, in 2 groups. La Zona group, area 49 pertenencias, lies about 8 miles southeast of Douglas, Arizona. La Princesa and La Costoza groups, area 100 pertenencias, are in the Ajo Mountains, 21 miles east of Cananea. Latter group, opened by a 180′ tunnel, showed promising sulphides at the end of 1905, and a 40′ shaft gave handsome oxide ores and bornite, averaging about 10% copper, with small gold and silver values. Property is considered promising.

CANANEA EASTERN MINING CO., S. A. **MEXICO.**

Is the Mexican incorporation of the Cananea & Eastern Mining Co.

MINA CANDELA. **MEXICO.**

A property in the state of Michoacán, México, said to possess a large body of low-grade sulphide ore. Local conditions are supposed to be much the same as at the Inguarán.

MINA CANDELARIA. **MEXICO.**

Mine office: Chacalá, Durango, Mex. Is owned and managed by P. G. Dismukes, T. L. Dismukes and J. S. Wilkinson. Ores are bismuthiferous and carry gold, silver and copper values. Has steam power, Bryan mill and a 6-ton chlorination plant.

CANDELARIA MINING CO. **MEXICO.**

Office: 100 Broadway, New York. Mine office: San Pedro, Chihuahua, Mex. E. D. Morgan, president; C. J. Reeves, secretary; N. C. Thompson, general manager; David B. Smith, superintendent. Is the principal mining company of northern Chihuahua, employing about 1,200 men. Lands, circa 1,700 pertenencias, area approximately 4,200 acres, also sundry grazing and miscellaneous lands, the mine tract being about ¾ mile wide by 5 miles long. Principal development is on the northern portion of the tract, with the 700′ San Pedro shaft, 700′ Candelaria shaft, 600′ San Nicolás shaft and 500′ Congreso shaft. Sundry other mines, including the Cobriza, have shafts of 175′ to 350′ depth, the company's mines having a total of about 3,200′ of shaft development, with circa 25,000′ of underground openings all told.

Country rocks are porphyry, diorite and limestone, ore bodies being somewhat erratic. The San Pedro is the oldest mine and has produced the highest grade ore. The Candelaria is now the largest and steadiest producer of high-grade ore, shipping selected ore of first grade giving average smelter returns of approximately 20% lead, 10% zinc, 8% copper, 400 oz. silver and 0.5 oz. gold per ton. The San Nicolás produces silver-lead and copper, latter as chalcopyrite. The Congreso mines mainly lead carbonates. Mines are wet, and company is installing a pumping plant of 3,000,000 gallons daily capacity. The company formerly operated a copper matting furnace at the mines, hauling coke therefor 90 miles in wagons, from Villa Ahumada, on the Mexican Central Railway, but later a railroad was built to Juárez, opposite El Paso, where a reduction plant, including concentrator and smelter, was built. This plant was sold to the Guggenheims, and Candelaria ores now are treated at the Aguascalientes works of the American Smelting & Refining Co. The Candelaria is a dividend-payer, and has an excellent management, both general and local.

CANDELARIA MINING & EXPLORATION CO. **MEXICO.**

Dead. Lands sold to Mexican Standard Mining Co.

CANTON MINE. **GEORGIA.**

An old and idle property in Fannin county, Georgia. Main shaft, about 300′. Ores occur as chalcopyrite impregnations in micaceous schist.

CANYON COPPER CO. **ARIZONA.**

Office and mine: Grandview, Coconino Co., Ariz. Jno. H. Page, president and general manager; H. H. Smith, secretary and treasurer; John

and three 300-ton copper furnaces, with automatic feed. Ore and
are handled in hopper-cars, drawn by 10-h. p. electric locomotive
first fusion matte contains 10% to 12% copper only, which is g
and roasted in two O'Hara furnaces, after which the calcined
briquetted and resmelted to a second matte averaging 50% in
tenor. The final product is blister copper. The works include
complete lead-smelting plant, handling silver-lead-zinc ores,
with an electrolytic lead refinery, the first ever built. During
works treated 240,000 tons of ore, producing therefrom 4,571,70
copper, 13,382,050 lbs. lead, 1,359,911 oz. silver and 82,644 oz. g
total value of $3,475,747.29, and also refined $320,000 worth of
from other works. Plant is well equipped, and smelting and refining
are modern and efficient.

CANANEA CONSOLIDATED COPPER CO., S. A.

Office and mine: La Cananea, Sonora, Mex. This company,
porated under Mexican laws, holds direct title to the mines of the
Consolidated Copper Co., the Greene company owning the entire sto
of the Cananea Consolidated.

CANANEA & DULUTH DEVELOPMENT CO.

Organized May, 1905, with capitalization $400,000, shares $
Apparently was succeeded, circa 1906, by Cananea-Duluth Mining Co.

CANANEA-DULUTH MINING CO.

Office: Hibbing, Minn. Mine office: La Cananea, Sonora, Mex.
McMillan, president; Walter J. Power, vice-president and gener
ager; S. L. Proctor, treasurer. Capitalization $500,000, shares $1 par.
erty is entirely paid for and company was out of debt, in spring o
Lands, 50 pertenencias, lying about 1,000' east of the Cobre Grande
the Greene Consolidated, extension of vein of which is supposed to
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CANANEA & EASTERN MINING CO.

Office and mine: La Cananea, Sonora, Mex. J. J. Williams,
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copper, with small gold and silver values. Property is considered

CANANEA EASTERN MINING CO., S. A.

Is the Mexican incorporation of the Cananea & Eastern Mining

April 30, 1888 (as a reconstruction of the Cape Copper Mining Co., Ltd. organized 1863), with capitalization £750,000, in £150,000 of 6% cumulative £2 preference shares and £600,000 in £2 ordinary shares; issued, £690,000. Dividend payments in 1901 were £224,250; in 1902 there was a net loss of £6,494; in 1903 a net profit of £95,979; in 1904 a net profit of £183,795 and in 1905 a net profit of £263,562. Dividends were 13s. in 1901, 5s. in 1903, 8s. 6d. in 1904 and 13s. in 1905. Annual accounts are made up to April 30, at the Cape, and to August 31, in London, and submitted in December. Separate accounts are kept for the Tilt Cove.

The Tilt Cove mine, in Newfoundland, is held on a 99-year lease, expiring 1989, at an annual rental of £4,400, plus one-half of net profits. The East Mines of the Tilt Cove produce sulphide ores averaging 3% to 3.5% copper, with small gold and silver values, while the West Mines have much smaller ore bodies, but of higher grade, averaging about 11% copper. Production 1901, was 73,500 long tons of ore, averaging 3.72% copper, equal to 6,122,000 lbs. fine copper and in 1905 the Tilt Cove made 5,104,960 lbs. fine copper. Ore was mined at an average cost of only $1.72 per ton. Ore reserves in the Tilt Cove mines are estimated at 125,000 long tons.

Company also is entitled to one-half the net profits of the Briton Ferry Chemical & Manure Co., Ltd., which takes the sulphurous gases given off by the smelters of the company's works at Briton Ferry, England. The Kjoli Mines, in Norway, have been given up. A Chilean property, held under option, was surrendered also, not proving satisfactory, and company is said to have an American mine under option.

The principal mines of the company are in Little Namaqualand, Cape Colony. The older of these, which are the O'okiep and Spektakel, were opened in 1852. Ores of the South African group are mainly chalcopyrite, with some bornite and chalcocite, intimately associated with pyrite, and showing occasional cuprite and malaconite, with a little malachite, azurite and crysocolla, near surface. The ore bodies are irregular, massive deposits of pyritic ores, associated with basic igneous intrusions in the granite and gneiss country rocks.

The O'okeip remains the principal African producer, but its ore reserves dwindle yearly, foreboding final extinction, being estimated by the company at only 6,000 long tons of 21% ore, in 1905. Production, 1905, was 6,117,440 lbs. fine copper. The O'okeip East mine is producing a limited amount of low-grade ore.

The Nababeep mine, opened 1890, is a good producer, furnishing 5% ore, and showed improvement in 1905. Reserves are estimated at 150,000 long tons of 5% ore. No. 4 trial shaft is being sunk on the Nababeep, the ores of which mine are intimately mixed with the greenstone, appearing as bunches and veins in the richer portions only. Production, 1905, was 5,136,320 lbs. fine copper.

The Narrap is a comparatively new property, which is showing fair ore. The Spektakel mine has ores occurring in both the granite and the basic intrusive rocks. Both the Spektakel and Koperberg mines are idle.

The Carolusberg East mine is undergoing development, and explorations were resumed at Coetzee's mine, 1905. On the whole the outlook at the South African mines is not especially reassuring, owing to failure to develop good new mines to replace the O'okiep.

There is a smelter at O'okiep, which is thoroughly modern in equipment, except that it lacks converters, product being shipped to Swansea as a 50% matte. Smelting is done for the Namaqua Copper Co., Ltd., which sells ore to the Cape Copper Co., Ltd., under contract. The mines and smelters are connected with Port Nolloth by a 100-mile railway, and at the port there are docks, wharves, cranes, tugs and lighters, for the receipt and dispatch of freight. Production, for the calendar year 1905, from all mines, was 16,358,720 lbs. fine copper. The company is an old and important producer, with a highly honorable history, and it is to be hoped that its efforts to find payable new mines may be successful.

CAPE D'OR COPPER DEVELOPMENT CO. **NOVA SCOTIA.**

Mine office: Cape d'Or, Cumberland county, Nova Scotia. Idle.

CAPE NOME GROUP.

Office: care of H. T. Wilkinson, owner, Missoula, Mont. Mine office: Clinton, Missoula county, Montana. Employs 5 men. Ole Erickson, superintendent. Lands, 7 claims, area 85 acres, partly patented, in the Wallace district, showing 5 fissure veins in granite, and one contact vein between granite and quartz-porphyry, of which 2 are being developed, these averaging 8′ between walls and giving average assays of 7% copper, 13 oz. silver and $1 gold per ton, from bornite, chalcopyrite and tennantite, with occasional small particles of native copper. Has shafts of 40′, 70′ and 300′, and tunnels of 75′, 350′ and 850′, latter in ore for 775′. A test shipment of 30 tons gave average returns of 7.5% copper, 15 oz. silver and $1 gold per ton. Management plans installing steam power and an air-compressor.

CAPILLITAS COPPER CO., LTD. **ARGENTINA.**

Offices: 6, Princes St., London, E. C., Eng. Mine office: Cerro de Capillitas, Tucumán, Argentina; Works office: Pilciao, Catamarca, Argentina. Geo. Grinnell-Milne, chairman; Nicol Brown, vice-chairman; J. G. Tait, secretary; J. S. MacArthur, consulting engineer; G. Le Royer, general manager. Organized November 25, 1901, with capitalization £600,000, shares £1 par, in £150,000 cumulative 7% preference shares, £150,000 cumulative 7% ordinary shares, and £300,000 deferred shares; issued, £585,000.

Lands are extensive, including the Capillitas and Atajo groups of mines, and the Pilciao and Constancia smelters, bought for £95,000. Company also has sundry lands fairly timbered. The Capillitas group of about 20 properties, district of Andalgalá, in the eastern part of the province of Catamarca, shows 12 veins. Principal developments by the former owners were on the Restauradora, Rosalia, Carmelita, La Grande and Oritz mines. These are being reopened by two tunnels, under the old workings at La Grande, and by one new tunnel, in the Restauradora. Ore from develop-

ment work has averaged about 15% copper, with good gold and silver values, being bunchy as a rule, but high in grade. The Atajo mines, 6 miles northwest of the Capillitas, have a smelter with 6 small reverberatory furnaces. The Maria Eugenia vein is about 7″ wide, giving 10% ore—not sufficient to pay, unless the vein grows much wider.

These mines are much the most important in Argentina, and have been worked irregularly, by local capital, since circa 1850. One of the principal difficulties in operation has been defective means of transport, as the mines are located in exceedingly rugged mountains, necessitating the shipment of ore to smelters by pack-mules. The mines are 8,000′ above sea-level, and more than 6,000′ above the temporary smelters and shops at Pilciao. The nearest railroad station is Chumbicha, 165 kilometres distant, over exceedingly rough and dusty roads. A traction-engine was tried, but stuck in the sand. The government has promised to extend the Córdoba Central railroad to Andalgalá, but the line is not likely to arrive until circa 1908. To cover the worst stretch between the mines and smelters, a single-line aerial tram has been ordered. This will be 22 miles in length, and the longest span is to be 2,765′, while in crossing one valley the cable will swing 625′ above the ground. The plant will weigh 2,000 tons, and is made in sections, for convenient packing on muleback. This tramway is designed to carry 40 tons of ore hourly, at a speed of 2.5 metres per second, cars being of 500 kilos capacity. It is hoped to have the tramway completed in 1907. The tramway will leave a 20-mile gap between Pilciao and Muschaca, over which transportation will be by carts.

The permanent smelter, with two 50-ton water-jacket blast-furnaces, is to be erected at Muschaca Quebrada, where there is plenty of room and water. About 225 h. p. will be generated from the Rio Andalgalá, and transmitted to the new smelter-site electrically. The new smelting plant has a 8½-kilometre pipeline, with dam, filter and tanks. The old Constancia smelters, with 2 reverberatory furnaces, have been overhauled, and in 1903 made 61 tons of matte averaging 62% copper, 60 oz. silver and 2 oz. gold per ton. Ores smelted by present company have averaged about 23% copper, 20 oz. silver and 15 dwts. gold per ton, but the grade undoubtedly will decrease with regular production.

Development work, while planned along sensible lines, seems very slow. There are many difficulties in the way of conducting mining and smelting operations in so rugged a district, especially when difficult of access, but nearly five years of work, and a 100-ton smelter not yet blown in, is slow progress. Comparison may be made with the Cerro de Pasco Mining Co., which in the same time has installed an immense reduction plant, under difficulties fully as great as those that the Capillitas company has had to face.

CAP SHEAF COPPER & GOLD CO. **BRITISH COLUMBIA.**

Said to have copper prospects on Texada Island, British Columbia.

CAPUZAYA MINING CO. **MEXICO.**

Mine office: Parral, Chihuahua, Mexico.

CARAHYBA COPPER MINING CO. BRA

Mine office: Alagoinhas, Bahia, Brazil.

MINA CARAMBOLA. MEX

Office and mine: care of D. Pablo Palacio, owner, Indé, Durango, M
Lands, 18 pertenencias, in two groups, opened by La Chusa shaft, 15 m
showing a 10′ vein of auriferous copper ore, carrying 4% to 30% c
and 30 oz. silver per ton. Average assay values range from 3.5% c
and 300 grams silver, in the argentiferous ore, to 14.5% copper and
oz. silver in the best copper ore. At close of 1905 mine was shipping
to 30 tons of ore daily.

CARBON COUNTY GOLD MINING & MILLING CO. WYOM

Mine office: Morgan, Carbon Co., Wyo. W. R. West, superintend
at last accounts. Ores carry gold, silver, lead and copper. Has st
power and a 10-stamp mill.

CARBONATE & LAURA MINES. COLORA

Mine office: care of Hoffman Bros., owners, Crystal, Gunnison C
Colo. Have gold-silver ores, carrying a little copper. Have wa
power.

CARDEÑAS COPPER CO. ARIZO

Absorbed, circa 1903, by Anita Consolidated Copper Co.

MINAS CARDENILLO y EL ARMADILLO. MEXI

Mine office: Tuxpán, Tepic, Mexico. Fernando Diaz, owner; A.
Gonzales, manager. Produce silver-copper ores. Have steam power a
employed 50 to 100 men, at last accounts.

CARIBBEAN MINING CO. COLORA

Office: Holyoke, Mass. Mine office: Ophir, San Miguel Co., Co
Chas. E. Newton, superintendent, at last accounts. Ores carry gold,
ver, lead and copper. Has water power and a 20-stamp mill.

CARIBOU GOLD & COPPER CO. IDA

Office: care of Frank A. Putnam, Gray, Idaho. Organized Sept
ber, 1903, with capitalization $2,500,000, shares $10 par, to develop cl
65 miles southeast of Idaho Falls, in Bingham county, Idaho. Said to h
an 8′ vein, traceable 3,000′. Idle.

CARIDAD COPPER MINING CO., LTD. SPA

Offices: 20, Lawrence Lane, Gresham St., London, E. C., Eng. M
office, Lozoyuela, Madrid, Spain. Robert Summerside Simpson, ch
man: Geo. Thompson, secretary. Organized February 15, 1899, and c
itanzation increased, 1901, to £350,000, shares £1 par; issued, £75,
Lands, 325 acres, including the Caridad, San Antonio and Descuido m
Idle.

MINA CARIDAD.

Office: care of Don Carlos Lacone, agent, Sevilla, Spain. W
oping fair-sized bodies of chalcopyrite and iron pyrites, at last a

MINA CARISA.

Office and mine: care of
Lands, 30 pertenencias, ci

carrying auriferous and argentiferous chalcopyrite. Has about 400′ of openings.

CARISA COPPER & GOLD MINING CO. **UTAH.**

Office: Salt Lake City, Utah. Mine office: Mammoth, Juab Co., Utah. Joseph E. Galigher, president; Henry S. Joseph, vice-president and general manager; Edw. H. Mead, secretary; F. J. Westcott, treasurer; preceding officers and Dr. E. D. Woodruff, directors; Ed. Hoffman, mine superintendent. Organized August, 1901, under laws of Utah, with capitalization $500,000, shares $1 par. Has levied assessments of $30,000, and has paid a dividend of $30,000, latter in 1902. Treasury showed a deficit of $3,409, July, 1905. Stock is listed on the Salt Lake City mining exchange.

Lands, 8 patented claims, area 57 acres, adjoining the Centennial-Eureka, in the Tintic district, showing 6 veins, as fissures in limestone and as contacts between limestone and quartzite, three of which are more or less developed, these averaging about 4′ width and giving average returns of circa 5% copper, 3 oz. silver and $2 gold per ton, from oxide and carbonate ores. Has three shafts, including the 250′ Carisa shaft and the 800′ Spy shaft, with a 7,000′ tunnel, and a total of about 5 miles of underground workings, estimated to show 80,000 tons of ore blocked out for stoping. Has a 100-h. p. steam plant, with 5 hoists, largest good for 1,500′, and a 3-drill Ingersoll air-compressor. Buildings include several small shops and 10 dwellings. Company also has a small electric light plant and sawmill. Production was 600,000 lbs. fine copper in 1904, and 400,000 lbs. in 1905. Company estimates 1906 production at about 1,200,000 lbs. Average cost of mining is about $5 per ton, and of smelting $4 per ton. At close of 1906 mine was developing a new and promising ore body.

CARLISLE COPPER CO. **MONTANA.**

Dead. Formerly held lands at Butte, Silver Bow county, Montana.

CARMACK GOLD & COPPER MINING CO. **WASHINGTON.**

Office: Arcade Bldg., Seattle, Washington. Mine office: North Bend, King Co., Wash. G. W. Carmack, president; L. O. Lane, secretary. Organized 1899, with capitalization $500,000, shares 25: par. Lands, 5 claims, on the south fork of the Snoqualmie river, 22 miles northeast of North Bend. Has 375′ of openings, showing veins of 12″, 30″ and 12′, giving fair assay values in gold, silver, lead and copper. Presumably idle.

MINAS DE CARMEN. **CHILE.**

Mine office: Carmen, Chañaral, Atacama, Chile. Simón Baldivieso, owner: Adriano Fernandez, manager. Lands, 15 hectareas, area 36 acres, including El Carmen, Carmela, Cardúmen, Mina Nueva, Araucana, Quiñazo Locura, Lautaro and other mines, showing two main veins, the Veta Manto ranging 4 to 12 metres in width, while the minor vein is 2 to 3 metres wide. Ores, in successive lenses along the veins, are oxides, carbonates and silicates, at and near surface, disseminated throughout the ferruginous gangue of the lenses. The Carmen mine shows an abundance of native copper, at approximately 200′ vertical depth. The sulphide zone,

reached at a vertical depth of about 110 metres, shows rich altered sulp
below which the ore is chalcopyrite, associated with arsenopyrite,
seminated in iron pyrites. El Carmen, the principal producer of the g
is opened by 2 shafts, 190 metres apart, sunk at an angle of 45°, o
vein, one being 85 metres and the other 190 metres in depth, shafts
connected by the extensive underground workings. The other mi
opened by various shafts, several having underground connections
the Carmen. The mines show reserves of about 75,000 tons of ore, v
from 6% to 15% in copper tenor. Mine has good steam power plan
employs about 100 men. Production, since 1895, has averaged about
tons of ore, averaging 10% copper, equal to circa 1,325,000 lbs.
copper yearly, and by reason of the new plant, should be considerabl
creased, beginning with 1906.

MINAS EL CARMEN AMPLIACION. MEX

Mine office: Cerralvo, Nuevo León, Mexico. Marciano E. V
owner and manager. Ores are argentiferous copper and lead sulp

CARMEN COPPER MINES, LTD. CHILE & NEWFOUNDL

Offices: St. George's House, Eastcheap, London, E. C., Eng.
office: Cerro Blanco, Copiapó, Chile. Alfred Hambley Rowe, chai
John Pye, secretary. Organized June 28, 1900, with capitalization £12
shares £1 par; issued, £75,307. Absorbed the Newfoundland Copper
Ltd., in 1901, thereby securing title to the Little Bay and Lady Pond
per mines, in Newfoundland, now idle. The Little Bay mine, ope
1878–1892, has a main shaft of 1,350′ and a small smelter, and was a
but steady copper producer, when worked.

Chilean property includes the Perseverancia mine, at Guanaco, T
the Carmen Bajo, in the Copiapó district, and the Bella Vista, Aguardi
other mines, in the Coquimbo district. The Copiapó properties are
but work was in progress in a small way on the other properties, at
accounts.

CARNARVON ASSOCIATED GOLD & COPPER MINES, LTD.

Organized January 31, 1903, under laws of Guernsey, with cap
ization £10,000, shares 10s. par. No business done.

CARNATION MINING CO.

Has mining property in vicinity of Empire Flats, on the Colorado
near Bill Williams Fork river, either in Yuma county, Arizona, or in
Bernardino county, California, and in 1905 planned combining with ot
companies, to erect a smelter at Empire Flats.

CARN BREA & TINCROFT MINES, LTD. ENGLA

Office and mine: Carn Brea, R. S. O., Cornwall, England. Fr
Harvey, J. P., chairman; T. Forster Brown, consulting engineer; J
Trevethan, secretary; Capt. J. Penhall, general manager. Organized M
24, 1900, with capitalization £150,000, shares £1 par; issued, £136,366. Pr
erty is tin and copper mines at Redruth and Illogan, Cornwall, formerly m
ing nearly 1,000 tons of copper yearly, but present annual production av
ages about 30,000 lbs. fine copper only, tin being the principal produ

CARNEY COPPER CO. **MICHIGAN.**

Office: care of John O. Broden, president, Norway, Mich. Mine office: Carney, Menominee Co., Mich. Antoine Anheier, superintendent. Organized 1904, under laws of Michigan, with capitalization $20,000. Has an 88′ shaft, showing ore in bottom assaying 1.4% copper. Plans deepening shaft and exploring lands with a diamond drill, during 1906.

GEORGE E. CARNE y OTRO. **CHILE.**

Own the Buena Vista mine, in the department of Tocapilla, Chile. Property, opened 1880, was idle at last accounts.

CAROLINA COPPER CO. **NORTH CAROLINA.**

Office: Royal Oak, Mich. Mine office: Cullowhee, Jackson Co., N. C. Idle. Lewis C. Waldo, president; Thos. A. Cox, vice-president and superintendent; Hugh M. McCormick, secretary. Organized October 12, 1901, under laws of Michigan, with capitalization $2,500,000, shares $25 par. Lands, 1,450 acres, showing 4 fissure veins, said to average 27′ width, carrying estimated average values of 3% copper, 4 oz. silver and $1 gold per ton, mainly from sulphide ores. Is opened by a 55′ shaft and 200′ tunnel. Property includes the old Wayehutte mine, and an undeveloped water power. Company hopes to resume work during 1906.

CAROLINA GOLD & COPPER CO. **NORTH CAROLINA**

Office: Salisbury, N. C. Mine offices: New London, Stanley Co., N. C., and Gap Creek, Ashe Co., N. C. M. H. Caldwell, president; Edwin C. Gregorie, secretary; Richard Eames, Jr., treasurer and general manager. Organized circa 1900, under laws of Arizona, with capitalization $2,500,000, shares $1 par. Lands, 350 acres, including the Parker mine, at New London, ores of which are reported by company to average 7% copper and $5 gold per ton. Ores are sulphide, with quartz gangue. Has steam power and a 5-ton 5-stamp mill, employing 10 men, at last accounts.

CAROLINA KING MINING CO. **NORTH CAROLINA.**

Mine office: Virgilina, Halifax Co., Va. Organized 1903, to take over property of the Copper World Mining Co., and the Danville & Virginia Copper Mining Co. The Copper World has two shafts, deepest 100′, in a vein of fair width, showing chalcocite, also carbonate and oxide ores, assaying 15% to 65% copper.

CARP LAKE MINING CO. **MICHIGAN.**

Office: care of H. L. Payne, general manager, Cleveland, Ohio. Lands, 1,087 acres. Work was begun in 1858, and the mine had a mill of 20 gravity stamps at one time. Mine is opened by shafts and adits, main adit 1,250′. Lode is about 7′ wide, being a continuation of the Nonesuch lode, and carrying very rich streaks in sandstone. Fully described in Vol. II.

MINAS EL CARPIO. **SPAIN.**

Mine office: Cortegana, Huelva, Spain. Area, 73 hectareas. Mines have 11 old shafts. Ore is cupriferous pyyrites. Idle.

CARR MINE & COLORADO CO., LTD. **COLORADO.**

Voluntarily wound up, April, 1903.

SOCIEDAD ANONIMA MINAS DE CARRACEDO.

Office: Bilbao, Spain. Mine office: Vañes, Palencia, Spain. ... erty was undergoing development, in a leisurely manner, at last ac...

CARRANZA-LAFONE COPPER MINING & SMELTING CORPORATION, LTD.

Property sold, 1904, to Capillitas Copper Co., Ltd.

CARRERAS HERMANOS.

Office and mine: Coro Coro, La Paz, Bolivia. Mine is opened o... successive strata of cupriferous conglomerates. See article on Boli... details. Only native copper is mined, and the product, as barillas de... is shipped through Mollendo, Perú, for refining. Employ 150 to 200... Annual output is equivalent to circa 600,000 lbs. fine copper.

CARRIE COPPER CO.

Dead. Formerly held lands near Globe, Gila county, Arizona.

SOCIEDAD DE MINAS y FUNDICIONES DE CARRIZAL.

Offices: 21, Ironmonger Lane, London, E. C., Eng., and Ca... 2489, Santiago de Chile. Mine office: Carrizal, Copiapó, Atacama, ... Samuel Gonzalez-Julio, chairman; Daniel Gonzalez-Julio, vice-chairm... Chilean board; Mark Clegg, chairman; Herbert J. Page, secretary, of Lo... board; L. Tirapegui, secretary in Santiago; Wm. H. Martin, general ... ager. Organized June, 1898, under laws of Chile, with capitali... $2,100,000, shares $100 par. Dividends, 1898–1899, 22¾%; 1899–1900, ... 1900–1901, 6.5%; 1901–1902, 6.5%. Operations for fiscal year ending M... 31, 1903, showed a loss of $114,840. Lands, 4 groups, in various par... the Carrizal district, province of Atacama, Chile, including the Chañ... mine, in the department of Freirina, opened 1857, which makes ... 1,800 tons of fine copper yearly; the Bronces, main shaft 408′, ope... 1881, at Jarillas Transito, Vallenaro, Atacama; the Amarilla, main ... 417′, opened 1867, at Cerro Blanco, Chañarcillo, Copiapó; the Astillas, ... shaft 260′, opened 1878, in the Carrizal district, and the Armonia and S... Margarita mines, of the famous Carrizal Alto group, at Carrizal Alto, F... rina, Atacama. Company has a 100-ton smelter, at Chañarcitos. The ... are dressed up to 12% to 15% copper, before taken to the smelter, and ... product, a matte of 45% to 50% in tenor, is shipped to Wales, for refi...

CARRIZAL SHARE TRUST, LTD.

Offices: 1, Laurence Pountney Hill, London, E. C., Eng. Owns sto... in the Sociedad de Minas y Fundiciones de Carrizal.

CARRIZO COPPER CO.

Office: 711 Missouri Trust Bldg., St. Louis, Mo. Mine of... Autlán, Jalisco, Mexico. Employs 50 men. Col. Kent E. Keller, presid... and general manager; Whit. Gilbreath, vice-president; W. M. Fenwick, se... retary and treasurer; E. E. Nicholson, general superintendent; George La... mine superintendent; Ramón Perez, smelter superintendent; Prof. H. A... Wheeler, consulting engineer. Organized December, 1905, under laws o... Maine, with capitalization $1,000,000, shares $1 par. Annual meeting, thi... Saturday in March. On March 12, 1906, had $12,000 cash on hand, an...

was without accrued liabilities. Lands, 198 pertenencias, also a 500-acre millsite and 8,000 acres timber lands. Country rock is diorite, showing numerous fissure veins, of which 2 are being developed, principal ore body being reported by company to average 51′ width and to be traceable for 1¾ miles. Mine is an antigua, discovered circa A. D. 1700, formerly worked for red oxides and native copper, which are shown at and near surface, with chalcocite and chalcopyrite at a little depth. Mine has a 200′ tunnel, and 1,100′ of mine openings, estimated to give 30,000 tons of ore blocked out for stoping, this averaging about 5% copper and 5 oz. silver per ton, with small gold values. Has a 25-h. p. hoist, good for 1,400′, a 3-drill air-compressor, 30x36′ carpenter shop, 30x36′ smithy, machine-shop, sheds and 20 dwellings. Has an electric light plant, 600-lb. ice plant and maintains a school for workmen and children. Has 4 small adobe furnaces, and plans building a small modern smelter. Plans for underground development call for sinking a 500′ shaft, and doing considerable crosscutting and drifting. Good ore bodies have been opened, and developments are satisfactory, but about a year will be required to prove the mine sufficiently for permanent equipment. Property is well managed and adequately financed, and seems to possess considerable merit.

CARTER COPPER CO. **VIRGINIA.**

Name changed, 1903, to Manassas-Gap Copper-Mines.

GUILLERMO CARVALLO. **CHILE.**

Operates the Fundicion Llallai mine, in the department of Quillota, Chile. Mine, opened 1900, makes matte equivalent to circa 500 tons fine copper yearly.

CASA GRANDE COPPER & GOLD MINING CO. **ARIZONA.**

Letters returned unclaimed from former office, Chicago, Ills., and former mine office, Casa Grande, Pinal Co., Arizona. Property was the Jack Rabbit mine, showing ore carrying gold and silver, with small copper values. Has steam power.

CASA GRANDE MINING & SMELTING CO. **ARIZONA.**

Office: 66 Broadway, New York. F. W. Pope, president; J. Douglass Taitt, secretary; H. H. Douglass, treasurer. Organized June 14, 1902, under laws of Arizona, with capitalization $5,000,000. Lands, 165 acres, 28 miles south of Casa Grande, Pinal Co., Arizona. Main shaft, 150′. A mere stock-jobbing device, put out, with aid of a lying prospectus, by that notorious gang of "mining" sharpers, Douglas, Lacey & Co.

CASCADE COPPER CO. **WASHINGTON.**

Said, in 1904, to be developing silver-lead ores, by tunnel, in the Horseshoe basin, Washington.

CASCADE COPPER MINING CO. **BRITISH COLUMBIA.**

Office: Victoria, B. C. Property is on Uchucklesit Harbour, Alberni division, Vancouver Island, British Columbia. Has an 8′ chalcopyrite ore body, said to give average assays of 19.6% to 28.3% copper and about $1.50 in gold and silver per ton. A shipment of 150 tons, to the Tacoma smelter, in 1904, gave net returns of $22.40 per ton.

CASCADE COPPER MINING CO. WYO

Letters returned unclaimed from former office, Chicago, Ills., and former mine office, Encampment, Wyo. Was a twin of the Ca Copper Mining Co.

CASCADES COPPER CO. WYO

Letter returned unclaimed from former mine office, Encamp Carbon Co., Wyo. John T. Baker, president; W. S. Russell, sec Capitalization $1,250,000, shares $1 par. Lands, 15 claims, in the Pasadena and High Five groups, circa 7 miles from Encamp opened by a 100′ shaft, showing a 20′ vein, and a 900′ tunnel, cutti smaller veins.

CASCADIA MINING & DEVELOPMENT CO. WASHIN

Succeeded, 1905, by Mt. St. Helens Consolidated Mining Co.

CASH MINE CO. ARIZ

Mine office: Groom Creek, Yavapai Co., Ariz. Harrington Bis general manager. Ores, carry gold, copper, silver and lead. Mine 2 shafts, with steam power and a 10-stamp mill.

CASH MINING & MILLING CO. COLOR

Succeeded by American Queen Mining Co.

CASHIER GOLD & MINING & REDUCTION CO. COLOR

Mine office: Central City, Gilpin Co., Colo. B. L. Campbell, sup tendent. Lands include the Brooklyn and adjoining claims, showing silver and copper ores. Has steam power.

CASTELLANOS y CA. CH

Operate a small mine, in the department of Combarbalá, Chile, ducing about 75 tons of bars and matte yearly.

MINA CASTILLO DE BUITRON. SP

Owned by Compañía del Ferrocaril y Minas del Buitron.

SOCIEDAD ESPAÑOLA MINAS DEL CASTILLO DE LAS GUARDAS. SP

Office: Apartado 68, Bilbao, Spain. Mine office: Castillo de Las Gua Sevilla, Spain. Employs 387 men. Alfredo de Echevarría, chair Victoriano Galdis, vice-chairman; Eduardo Barandiaran, secretary; F cisco Trárraga, superintendent; Ramón de Urritia, engineer. Organised J 12, 1901, under laws of Spain, with capitalization 7,500,000 pesetas, sh 500 pesetas par. Lands 153.38 hectareas. Property is in process development. Company maintains a school for children. Is 23 kilometers from Zalamea La Real, and has a private railway of 15.5 kilometers, run from Castillo de Las Guardas to Ronquillo station, on the Ferroca Sevilla y Cala. Is a property of considerable promise, and is being develop systematically.

CASTLE DOME DEVELOPMENT CO. ARIZON

Mine office: Globe, Gila Co., Ariz. Richard Roskelley, superintendent Is sinking a 4x8′ shaft.

CASTLE DOME EXPLORATION & REDUCTION CO. ARIZO

Office: care of B. L. Worthen, president, Tucson, Ariz. Chas.

Flack, secretary and treasurer; Jas. H. Bennett, general manager. Capitalization $500,000, shares $10 par. Lands, 17 claims, area 320 acres, 18 miles north of Gila City, Yuma county, Arizona, from which occasional small shipments have been made to smelters in San Francisco, during the past 25 years, these ranging from 37% to 52% copper; 50 oz. to 70 oz. silver and $8 to $20 gold per ton. Development is by 10 open-cuts, and shallow shafts, deepest only 80′. Property shows a wide mineral zone, carrying ore bodies in schist, with a porphyry contact to the north, and quartzite and limestone to the south. Presumably idle.

CASTREJON HERMANOS. **MEXICO.**

Own copper properties in the Huacana district, Ario, Michoacán, Mexico.

CASTRO-GRECIAN MINING CO. **UTAH.**

Letter returned unclaimed from alleged mine office, Bingham Canyon, Salt Lake Co., Utah. J. P. Buzanes, president; L. C. Moore, secretary and treasurer. Organized 1905, under laws of Utah, with capitalization $1,500,000, shares $1 par. Lands, sundry claims at Bingham, also miscellaneous claims in Carbon, Emery and Wasatch counties, Utah. Latter lands apparently sold, circa September, 1905, to Uintah Mining, Milling & Development Co., letter addressed to which company also has been returned, unclaimed.

CATALINA COPPER CO. **MEXICO.**

Office: Bisbee, Ariz. T. J. Wyatt, J. M. Johnson and D. H. Hobbs, directors. Organized February, 1904, with capitalization $500,000, shares $10 par. Lands are about 30 miles south of La Cananea, in the Arizpe district of Sonora, Mexico. Presumably idle.

CATALINA COPPER MINING CO. **ARIZONA.**

Dead. Fully described in Vol. V.

CATARACT COPPER MINING CO. **MONTANA.**

Office: 308 The Bourse, Philadelphia, Pa. Mine office: Cataract, Jefferson Co., Mont. Carl S. Weidinger, president; Saml. B. Vrooman, vice-president; Marcus L. Hewett, second vice-president and general manager; Wilbur F. Middleton, secretary; J. L. Ketterlinus, treasurer; G. H. Bartlett, mill superintendent; J. Dwyer, smelter superintendent. Organized 1901, under laws of South Dakota, with capitalization $2,500,000, shares $5 par.

Lands, 21 claims, area 425 acres, also 300 acres of placer claims, in the Cataract district, circa 12 miles from Basin and 30 miles from Butte—not a few miles, as claimed by the promoter. Company is supposed to hold 8 claims, under option. Lands include the Bullion, Buckeye, Gray Eagle, Cataract, Yellow Gambler, Timbuctoo and Goldbug properties. Principal development is on the Bullion mine, which is said to have upwards of 8,000′ of workings. Development is by four tunnels. No. 1 tunnel, 235′, is said to show a 4′ to 8′ vein. No. 2 tunnel, 200′ vertically below No. 1, and 1,300′ in length, is said to show a 10′ to 14′ vein, and has a 200 upraise at 900′ from portal. No. 3 tunnel, 200′ vertically below No. 2, is said to be 3,600′ long, and not 5,000′, as claimed in company's advertisement, and

shows a fissure vein, in granite, of 10′ to 30′ width, with paystreak averaging 5′. Gangue is altered granite, somewhat silicious, carrying iron pyrites and quartz, gold values being associated with the iron and quartz. No. 4 tunnel is 640′ vertically below No. 3. Ore developed is claimed to average $10 to $12 per ton, and values are said to be largely in gold. Geological formation is claimed by company to be the same as in Butte. The Buckeye mine is said to show a 20′ vein of concentrating ore, with a 4′ paystreak of shipping ore. Equipment includes a 6-drill air-compressor and necessary mine buildings. The concentrator, of 150 tons nominal daily capacity, seems to have been built wrong, and has given no end of trouble, but in February, 1906, was running, reducing about 90 tons of crude ore to 40 tons of low-grade concentrates daily.

The company guaranteed to have a 300-ton smelter in blast July 1, 1903, and actually blew in a 275-ton smelter just one year later. This is a 44x144″ Colorado Iron Works water-jacket blast-furnace, with blast heated to 800° F. in a "U" stove. Equipment includes a 150-h. p. engine, Connersville blower and a small electric plant. Smelter is very poorly located for economical receipt of fuel and fluxes. The company has been sued by the Colorado Iron Works on account of this plant.

The company is endeavoring to sell 115,000 shares of stock, at £1 each, in England, to provide funds for doubling the capacity of the concentrator and smelter, and figures on a profit of $1,260,000 per annum therefrom, which shows that the statistical department of the company is much more capable than the operating department. Newspaper stories that J. Pierpont Morgan had invested $60,000 in this property carry their own refutation. A trial run of 6,000 tons of ore, in 1905, gave a matte of 10% to 15% average tenor, with an average return of 2.29% copper, 18 oz. silver and $7.60 gold per ton from the ore treated. The December, 1905, payroll, is said to have been $17,000, and at end of the year the property was producing about 110 tons, from the Bullion mine, and shipping two cars of low grade concentrates daily. The promoter of this company, Marcus L. Hewett, is said to have made individual profits of $75,000 from the sale of the company's stock—hence it would be unfair to call the mine unprofitable.

CATARACT COPPER MINING CO. **WYOMING.**

Letters returned unclaimed from former office, Chicago, Ills., and former mine office, Encampment, Wyo. Was a twin of the Cascade Copper Mining Co.

SOCIÉTÉ DES MINES DE CUIVRE DE CATEMOU. **CHILE.**

Offices: 50, Blvd. de la Senne, Brussels, Belgium, and 50, Blvd. Haussmann, Paris, France. Mine office: Nilgue, Estacion Chagres, Putaendo, Chile. Achille Adam, president; Max Lyon, managing director; preceding officers: Georges de la Bouglise, Comte F. Balny d'Avricourt, Comte Hubert Delamarre, Auguste Collignon, Arthur L. Pearse, Eugene Renery and Georges Renery, directors; Guillaume Wouters, secretary; C. H. Macnutt, general manager; F. C. Vigeon, superintendent; J. R. Starkey, mill superintendent. Organized June 2, 1899, under laws of Belgium, with capitalization 5,000,000 francs,

shares 500 francs par, divided into 10,000 preference 8% shares, with an issue of 35,000 founders' shares, of no nominal value. Debentures, 2,500,000 francs authorized, at 5%; issued, 1, 070,000 francs. Annual meeting, last Friday in June.

Lands, 155 claims, with sundry miscellaneous tracts, held in fee and under government concessions, giving total landed holdings of about 30,000 acres, in the districts of Putaendo, Los Andes, Melipilla, La Ligua, Quillota and El Nilgue, including the following mines: El Cobre de Melon, in the Quillota district, opened 1886; El Nilgue mine, in the department of Putaendo, opened 1886; Las Maquinas de Catemú mine, in the department of Putaendo, opened 1870; Los Mantos mine, opened 1820; El Salado mine, opened 1841; La Esmeralda mine, opened 1860, and El Soldado mine, developed principally by tunnels. Country rocks are porphyry and trachyte, mainly the latter, showing contact and fissure veins, 40 different ore bodies of various kinds, sizes and promise being under development. Local management reports that ores carry an average of 6% copper, but a director states that the average will be only about 3.5% copper and 2 oz. silver per ton. Veins carry the usual oxide and carbonate ores near surface, and show chalcocite, bornite and chalcopyrite at comparatively slight depths. The mines were worked for many years by the old Chilean methods, but have been systematically developed, and are operated along modern lines, since taken over by the present company. Mine development is by tunnels, without steam-power equipment.

The reduction works, including mill and smelter, has a 450-h. p. steam plant. The 60-ton concentrator, completed 1904, is equipped with 7 Wilfley and Ferrari tables, 1 sampler and 1 slime table.

The smelter, distant 1 to 5 miles from the various mines, receives ore by carts, aerial trams and ground-trams. The smelter has been enlarged to 400 tons daily capacity, having two 75-ton rectangular water-jacket blast-furnaces and new blast-furnaces of 36x96″ and 36x120″, turning out 45% matte, which is reduced to blister copper in a converter having five 57x77″ shells of the Copper Queen type. Final product is Chile bars carrying 99.7% copper and 32 oz. silver per ton. Fuel is bituminous coal, costing $12.50 per ton, for the mines and concentrator, and coke, costing $15 per ton, for the smelter, annual consumption being about 8,000 tons. Property is served by the Chilean state railway, 10 miles distant from the mines.

Production has been increased, from 935 metric tons in 1902, to 1,980 metric tons in 1904 and 2,450 metric tons in 1905. It is planned to increase the output to about 3,000 metric tons fine copper yearly. The management is good, and the properties are being developed along systematic and thoroughly sensible lines.

CAUCASUS COPPER CO., LTD. RUSSIA.

Offices: 3, Bond Court House, Walbrook, London, E. C., Eng. Mine office: Dzanzul, Kutais, Russia. A. A. Swan, chairman; H. H. Knox, consulting engineer; T. Breakell, general manager; John Tripp, secretary; W. R. Van Liew, works superintendent. Organized October 4, 1900, with capitalization £500,000, shares £1 par. Debentures, £500,000 authorized, at 6%; issued, £367,000.

Property is in six groups, known as the Dzansulski copper and silver-lead mines, in the Murgne Gorge, Artoin district, Government of Kutais, Russian Caucasus. Considerable development has been secured, and the company estimated, April, 1905, that the mines had in sight 3,600,000 tons of 3.1% copper ore, carrying small gold and silver values. Ore is chalcopyrite, with a silicious gangue, occurring in a mammoth lense of 50 metres to 150 metres width by about 300 metres length. The old works had a small smelter, increased by present owners to 300 tons daily capacity, but the ore slimes badly when concentrated, and is so high in silica and deficient in iron that heavy fluxing is necessary, in a district where fluxing ores are secured with difficulty. Smelting was suspended September, 1904, and a Wetherill magnetic separating plant installed, the new mill, with a daily capacity of 500 tons, being intended as the first unit of a 1,000-ton mill. Production was 1,946,360 lbs. fine copper in fiscal year 1904, and 511,920 lbs. fine copper in fiscal year 1905. Operations have been conducted under great difficulties, including apparently unnecessary restrictions from the Russian government, which have greatly hampered operations. Management is good, and the property, notwithstanding the drawbacks enumerated, is valuable, and likely to make a large and profitable mine eventually.

MINA DA CAVEIRA. **PORTUGAL.**

Mine office: care of Crookson & Hawkins, owners, Grandola, Portugal. Was in process of development, at last accounts.

CEDAR FOREST GOLD & COPPER CO. **ARIZONA.**

Letter returned unclaimed from former office, Los Angeles, Cal. Mine office: Kingman, Mohave Co., Ariz. Organized August 27, 1903, under laws of Arizona, with capitalization $600,000, shares $1 par. Lands, 9 claims, area 180 acres, near headwaters of the Big Sandy river, claimed to show a 25′ vein carrying gold and copper. Advertisements of company prove that its promoters either were dishonest, or else totally ignorant of copper mining.

CEDAR VALLEY GOLD & SILVER MINING CO. **ARIZONA.**

Mine office: Cedar, Mohave Co., Ariz. Philip P. Baker, superintendent. Lands include the Arnold, Silver Queen and other claims. Ores carry gold, silver and copper. Has steam power and a 15-stamp mill.

COMPAÑIA MINERA EL CEDRO. **MEXICO.**

Mine office: Guanajuato, Gjto., Mexico. Vincente Gonzales, manager. Has steam power and is a producer of gold and copper, employing circa 50 men, at last accounts.

CENTENNIAL-BINGHAM MINING CO. **UTAH.**

Succeeded, 1904, by South Columbus Mining Co.

CENTENNIAL COPPER MINING CO. **MICHIGAN.**

Office: 60 State St., Boston, Mass. Mine office: Calumet, Houghton Co., Mich. Mill office: Point Mills, Houghton Co., Mich. H. F. Fay, president; Geo. G. Endicott, secretary and treasurer; Jas. Chynoweth, superintendent; preceding officers, John C. Watson, W. B. Mosman, Wm. Howell Reed and Stephen R. Dow, directors; John Pentecost, chief mining captain; G. S. Goodale, engineer; Alonzo Nicholas, chief clerk; Alex. G. Andrews, master mechanic. Organized 1896, under laws of Michigan, as successor of the Cen-

tennial Mining Co., with capitalization $2,500,000, shares $25 par; issued, $2,250,000, with $19.50 per share paid in. Last assessment was $4, paid 1905, in two installments. Annual meeting, first Tuesday in April. Old Colony Trust Co., Boston, registrar.

Official returns to the state of Michigan, as of date Jan. 1, 1905, disclose the following figures:

Amount of cash paid in on capital stock	$1,390,228.00
Entire amount invested in real estate	418,295.24
Amount of personal estate	353,614.47
Amount of floating debt	335,894.24
Amount due company	28,637.70

The floating debt includes $300,000 in notes, due 1907, given for the Arcadian stamp-mill.

Lands, circa 670 acres, being Section 12, Town 56 North, Range 33 West, also a triangular patch of about 30 acres, at the southeastern corner of the main tract, bought to secure the outcrop of the Kearsarge lode, and including about 10 acres, bought of the old Colony, in 1905, for the surface plant. The first work was done, 1863, by the Schoolcraft Mining Co., which failed to open a paying mine, and was reorganized, 1876, as the Centennial Mining Co., and again reorganized, 1896, with present title. Expenditures of upwards of $1,500,000 were made, mainly by the old companies, in unsuccessful efforts to open a paying mine on the northern extension of the Calumet conglomerate. Seven shafts, 3 of considerable depth, were sunk on this bed, No. 3, the deepest, being bottomed at 3,200′. Work on this lode was sufficiently extended to fully demonstrate the worthlessness of the Calumet conglomerate on the Centennial property. The Centennial lands are in the great mining camp of Calumet, and are available for building purposes. Two additions have been platted, and the lots sold at good prices. Only surface rights are sold, mineral being reserved by the company.

The present management wisely abandoned the conglomerate shafts in 1897, after a few months' efforts, and deepened two shallow shafts on the Osceola lode. These are 17x12′ inside of timbers, sunk at an angle of 38°, and are 1,050′ and 1,150′ in depth, respectively. Upon securing the 20-acre tract carrying the outcrop of the Kearsarge lode, which underlies the Centennial's entire square mile of territory, the work of development was begun, September, 1899. Owing to the narrow width of the tract secured from the Osceola company, it was necessary to develop it in a peculiar manner, by two shafts, Nos. 1 and 2, which are but 90′ apart at a surface, and continue parallel on the dip of the lode until the 13th level, when the Centennial's main tract is reached, after which No. 2 diverges from No. 1 at an angle of 15° on the plane of the lode, 300′ being taken by a curve to secure the divergence of 15°. This plan of opening gives short drifts, until the shafts enter the main Centennial tract, after which length of openings is gained rapidly with depth. Each shaft is 7x18′ inside of timbers, with three compartments, and sunk at an angle of 39° with the horizon. The overburden is about 100′, and the amygdaloid averages about 16′ width. Fair copper values were obtained in the first few levels, after

which a comparatively barren zone was penetrated, until the 14th level was reached, after which came gradual improvement. The 25th and levels below show excellent copper ground, with many good stopes. The mine had about 6 miles of underground openings, at the close of 1905, and is developing at the rate of about 8,000′ per annum.

No. 1 shaft, 3,070′ deep, Jan. 1, 1906, can be sunk 12,000′ before reaching the Centennial's boundary. This shaft shows greatly improved ground below the 24th level, and also appears better in the north drifts of the upper levels. No. 1 has 5-ton skips, operated by a 32x72″ duplex cylinder Nordberg hoist with double conical drum, good for a depth of 6,000′.

No. 2 shaft, 2,700′ deep, Jan. 1, 1906, is fully opened to the 14th level, but for part of remaining depth is merely a winze, this having been made for both ventilation and safety. The shaft will be cut down to full working size, and timbered, during 1906. The temporary hoist will be replaced, in 1906, by the permanent winding engine, which is on the ground. The new engine is a 32x60″ duplex cylinder Sullivan Corliss straight-face hoist with 2 drums of 14′ diameter and 15′ 6″ winding face, grooved for 1⅜″ wire cable. The hoist is fitted with devices to prevent over-winding, and is calculated to raise its maximum load of 5-ton skips at the rate of 4,000′ per minute, operated under 150 lbs. steam pressure. New engine and compressor houses are to be built at No. 2 shaft, in 1906.

Owing to the juxtaposition of the shafts, rendered necessary by the peculiar conditions that gave the company merely a right-of-way into the main tract, but one rockhouse is required, this being at No. 1 shaft. This combination shaft-rockhouse is of wood frame, with corrugated iron sheathing, and has 3,000-ton rockbins. The rockhouse has 18x24″ rock-crushers and is connected with No. 2 shafthouse, 90′ distant, by trestle, with mechanical haulage for loaded and empty tram-cars.

The engine house is of stone, as is the 32x46′ compressor-house, which has 35-drill Nordberg and 18-drill auxiliary air-compressors, and a Dean jet condenser in the basement. A new high-duty compressor will be added in 1906. The 54x58′ boiler-house has four 125-h. p. Burt locomotive firebox boilers, and a 125′ brick-lined self-supporting steel smokestack, of 7′ diameter. A 16x46′ frame pumphouse, with corrugated iron roof, has a fire-pump, fire-hose and hose-carts. The combination machine-shop and smithy is 50x108′, with redstone walls and steel truss roof, fitted with traveling cranes and a full complement of shop and blacksmithing tools, and has a railroad track running from end to end. The carpenter shop is 36x50′ and the warehouse is 30x40′ in size. A new office building is 30x40′, and the miners' change-house is 25x50′, with hot and cold waters, lockers, etc. The company also has a large number of substantial dwellings for employes, and the surface plant is one of the best, both in plan and equipment, to be found in a district where good plants are the rule. The mine is served by the Copper Range and Mineral Range railroads, connecting with the company's private rail line.

The old single-head mill, at the mine, having survived its usefulness, was dismantled, 1904, and the Arcadian mill, at Grosse Pointe, Portage Lake,

bought for $296,000, with three years' time in which to pay for it. The 406-acre millsite has 1¼ miles water frontage, with ample room to waste all sands, and has a number of good dwellings for the use of the employes. The 132x124' steel mill has 3 Nordberg stamps, with foundations built for 3 more heads. There is a 15,000,000-gallon Nordberg pump, auxiliary machine-shop, smithy, etc. The foundations under the heads were in bad shape, and a new 12' concrete foundation was given one head, which was rebuilt and compounded, giving it a daily capacity of about 700 tons. A second single-stage head has been overhauled, and is crushing Centennial rock, the compound head being under lease to the Allouez. The third head is as yet in reserve. Crushing rolls have been installed to treat the oversize, adding materially to the mill's capacity, and a cooper shop was built. 1905. The mill has a wharf, running 675' into deep water, and is fitted with modern coalhoists and a good coal-shed. The intake of the pump has been extended several hundred feet, into deeper water.

Production was begun July 5, 1904. The output of fine copper was 641,294, lbs. in 1904, and 1,446,584 lbs. in 1905. During 1905, about 20% of the rock rendered available by new openings was stoped, balance being added to the mines' reserves, and 18% of the rock broken was discarded. The 84,890 short tons crushed gave 2,069,490 lbs. mineral, which averaged 70% fine copper in the smelter, giving a net return of 17.4 lbs. fine copper per ton. While these returns are not what had been hoped for, they can be made to pay, if needs must, when the mine is extensively opened and production secured on a large scale, but the showing in the lower levels of the mine fully warrants the expectation of better average values at greater depth. Expenditures for 1905 were $348,283.17, including $47,899.34 laid out in new construction, and income from copper produced was $230,129.48. The fact that but one-fifth of the ground opened was stoped partially explains this discrepancy between outgo and income. The Centennial has proven somewhat disappointing to date, but the management has displayed commendable courage and foresight in continuing underground development steadily and providing the surface equipment for a big mine. With better average stopes, such as are promised by the lowest levels yet opened, the figures of annual results should prove more satisfactory to shareholders.

CENTENNIAL-EUREKA MINING CO. **UTAH.**

Offices: 50 Congress St., Boston, Mass., and 508 Dooly Bldg., Salt Lake City, Utah. Mine office: Eureka, Juab Co., Utah. Wm. G. Sharpe, president; Alfred F. Holden, managing director; preceding officers, Wm. H. Coolidge, Robert D. Evans. Clarence A. Hight, J. J. Storrow and Sidney W. Winslow, directors; F. Winthrop Bachelder, secretary and treasurer; C. E. Allen, superintendent. Organized 1899, under laws of Maine, (as a reconstruction of an old company of the same name, organized 1876, under laws of Utah), with capitalization $5,000,000, shares $25 par; issued, $2,500,000. National Shawmut Bank, Boston, registrar Annual meeting, third Wednesday in April. This company and its predecessor paid dividends of $2,750,000 to end of 1904; dividend November, 1904, was $150,000. Control of company is owned by the United States Mining Co., which holds all but about 200 shares.

Lands are sundry claims in the Tintic district, near Eureka, including the Dove, Swan and Pelican groups, adjoining the original mine, bought circa January, 1906, which are considered promising. The mines are extensively developed and produce ore of two grades, the oxides and carbonates carrying high values in gold and silver and ranging $10 to $30 per ton in value. The low-grade deposits are of enormous extent, but carry only small values in gold and silver. Property was examined, early in 1905, by J. Parke Channing, a conservative and competent authority, who found reserves of 600,000 tons of ore, carrying average values of $11.88 per ton. The East Fissure has upwards of 500,000 tons blocked out. Product is treated by the United States smelter, at West Jordan, though some ore was shipped, late in 1905, to the Mammoth smelter in California, both properties being controlled by the United States Mining Co. Employs 200 men.

CENTENNIAL MINE. **COLORADO.**

Office and mine: Georgetown, Clear Creek Co., Colo. David Kennedy, general manager; S. G. Evans, superintendent. Lands, circa 640 acres. Has cupriferous gold and silver ores in a 30″ paystreak, opened 1903, assaying up to 24% copper, 5 oz. to 150 oz. silver and 3 oz. to 5 oz. gold per ton. Has steam power and employed about 20 men, at last accounts.

CENTRAL ALASKA GOLD & COPPER CO. **ALASKA.**

Office: care of Founders Trust Co., 403 State Life Bldg., Indianapolis, Ind. Was known formerly as Alaska Gold & Copper Co. Reorganized, circa 1905, under laws of Washington, with present title. Lands claimed are 28 placer claims, circa 220 miles north of Valdez, Alaska, on the Chistochina river. Company's advertising is very flamboyant, and especially unilluminating.

CENTRAL ARIZONA MINE. **ARIZONA.**

Mine office: Williams, Coconino Co., Ariz. Rounseville & Hardesty, owners; E. M. Hardesty, superintendent. Ores carry gold, silver and copper. Has gasoline power. Idle.

CENTRAL BLACK HILLS COPPER CO. **SOUTH DAKOTA.**

Office: 701 New England Bldg., Cleveland, Ohio. Mine office: Custer, Custer Co., S. D. E. M. Barnes, president and general manager; L. M. Chartrain, secretary; H. H. Francis, superintendent. Organized July, 1902, under laws of South Dakota, with capitalization $1,500,000, shares $1 par. Lands, 30 claims, area 600 acres, also a 40-acre millsite and miscellaneous lands giving total holdings of 720 acres, in the Pennington district, showing sundry veins, of which two, of 18′ average width, opened by shafts of 85′ and 110′, and by tunnels of 42′ and 225′, are contacts between slate and quartzite, giving average assays of 6% copper, 2 oz. silver and $4 to $200 gold per ton, from malachite, azurite and chalcopyrite. Ore is expected by company to average about 3% copper in actual treatment. Has a 200-h. p. steam plant and power drills, concentrator with 2 crushers and 4 jigs, and a 100-ton leaching plant, planned to turn out cement copper. Also has a sawmill. Property shows large bodies of low-grade ore that gives promise of successful treatment by lixiviation, but present management does not seem equal to the task of development.

CENTRAL CHILI COPPER CO., LTD. **CHILE.**

Offices: 15, Angel Court, London, E. C., Eng. Mine office: Panulcillo, Ovalle, Coquimbo, Chile. Employs 350 men. Eugene A. J. Goldschmid, chairman; Bertrand C. Hinman, managing director; Harris K. Masters, general manager; Henry B. Greenwood, secretary. Organized Jan. 10, 1898, as a second reconstruction of the Panulcillo Copper Co., Ltd., with capitalization increased, November, 1905, to £400,000, shares £1 par; issued, £306,248. Debentures outstanding, £16,798, at 4%.

This company and its predecessors have worked the Panulcillo mine since 1894. Group includes the Panulcillo and San Gregorio, at Panulcillo, and the Inagotable, Cocinera and Condesa mines at Huamalota Sataqui, Ovalle. Mines, except the Panulcillo, are small. Ores produced are malachite, azurite, chalcocite and chalcopyrite. The increase in capitalization was made for the purpose of developing the Cocinera group of four mines, which are said to show nearly 2,000,000 long tons of ore. Ores of the other mines range 3% to 7% in copper tenor.

The 200-ton smelter is connected with the Panulcillo mine by tramway, and the product is matte, shipped to New York for refining, but a converter plant is to be erected. Production, 1905, was 4,593 480 lbs. fine copper. The property is one of considerable value, and its future prospects seem much improved.

CENTRAL GOLD & COPPER CO. **NEW MEXICO.**

Letter returned unclaimed from former mine office, Mineral Hill, N. M.

LA GRAN FUNDICION CENTRAL MEXICANA. **MEXICO.**

Office and works: Aguascalientes, Aguascalientes, Mexico. Is owned and operated by the American Smelting & Refining Co.

CENTRAL MINING CO. **MICHIGAN.**

Wound up, 1905 and lands sold to Calumet & Hecla Mining Co., for $160,000. Was long a considerable producer, and paid dividends of $2,030,000

CENTRE STAR CONSOLIDATED MINING CO. **BRITISH COLUMBIA.**

Mine office: Rossland, Yale district, B. C. Employs 350 men. E. B. Kirby, manager. Organized January, 1906, as successor of the Centre Star Mining Co., and is controlled by the Consolidated Mining & Smelting Company of Canada. The Centre Star Mining Co. paid $210,000 dividends, 1895-1904. Mine is extensively developed, but high-grade ores of upper workings were nearly exhausted at the end of 1905, leaving large low-grade ore bodies. Diamond drilling has shown a continuance of the higher-grade ore lost on the 8th level, and this ore body is to be opened. Mine is connected with the War Eagle mine on the 9th level. Mine is to be equipped with a new hoist, of great capacity, and plans shipping large quantities of low-grade ore, to the Trail smelter. For 1904, production was 77,892 tons ore, averaging 0.72 % copper, 0.35 oz. silver and 0.36 oz. gold per ton, giving an average of $7.75 per ton, gross smelter values. Mining costs, for fiscal year 1903, were only $1.97 per ton.

CENTRE STAR MINING CO., LTD. **BRITISH COLUMBIA.**

Succeeded, January, 1906, by Centre Star Consolidated Mining Co.

CENTURY MINE. **ONTARIO.**

Office: care of Foster & Black, Sudbury, Ont. Lands are in Graham Twp.,

Algoma, Ontario, showing ores giving assays of 7% to 13% copper, and from a trace to $26 gold per ton.

CERESIER MINE. **FRANCE.**

Once was the principal copper producer of France. Idle many years.

CERMA DEVELOPMENT CO. **ARIZONA.**

Office: Calumet, Mich. Organized, 1903, to develop a group of 47 claims in the Huachuca Mountains, Cochise county, Arizona. Idle.

CERRO COPPER CO., LTD. **PERÚ.**

Offices: 21, Ironmonger Lane, London, E. C., Eng. H. J. Page, secretary. Organized Oct. 27, 1900, with capitalization £101,000, shares £1 par: issued, £16,416. Has abandoned property formerly held in the Cerro de Pasco district of Perú.

SOCIEDAD CERRO DE PASCO. **PERÚ.**

Supposed to be Peruvian title of the Cerro de Pasco Mining Co.

CERRO DE PASCO INVESTMENT CO. **PERÚ.**

Office: 5-15 Broad St., New York. Jas. B. Haggin, president. Has some occult connection with the Cerro de Pasco Mining Co.

CERRO DE PASCO MINING CO. **PERÚ.**

Office: 5-15 Broad St., New York. Peruvian general office: Lima, Perú. Mine office: Cerro de Pasco, Junin, Perú. Works office: Tinahuarco, Junin, Perú. Railroad office: Oroya, Perú. Mine is owned by Jas. B. Haggin, J. Pierpont Morgan, H. Mck. Twombley, and other wealthy residents of New York. President is a figurehead, changed occasionally, Jas. B. Haggin being president to all practical intents and purposes; H. Esk Moller, secretary; Alfred W. McCune, general manager; Frank Klepetko, consulting engineer; C. H. Repath, assistant consulting engineer; A. A. Abbott, mine superintendent; W. F. Blackford, engineer; John J. Case, smelter superintendent. Organized June 6, 1902, under laws of New Jersey, with capitalization $10,000,000. Has some connection financially with the Cerro de Pasco Investment Co., which presumably has been put up as a shield, to guard the mining company from the devious attacks of grafters, both Peruvian and domestic.

Lands, circa one square mile, including about three-fourths of the rich Cerro de Pasco district, said to have been bought at a cost of about $2,650,000. Company is also said to have bought copper claims in the Yauli and Morococha districts of Perú. Miscellaneous lands include a smelter-site, and extensive coal tracts north of Cerro de Pasco.

The Cerro de Pasco district is located 14,300′ above sea-level, rendering physical labor very fatiguing. The population of the town is variously estimated at 5,000 to 20,000. The surrounding country is bleak, and all food and supplies must be brought in from considerable distances. The year is divided into two periods, the wet and dry, the wet season being from November to April. The summers are not hot, owing to the great altitude, and the winters are not cold, owing to the low latitude. Snow and hail fall at any time, summer or winter, but rarely remain on the ground as long as 48 hours, even in winter. The fluctuation between mean summer and winter temperatures is about 20° Fahrenheit, only.

Silver was discovered at Cerro de Pasco in 1630, and the production of the district, to the close of the Nineteenth Century, is estimated at 450,000,000 ounces, secured from about 40,000,000 tons of silver and copper ore, nearly all extracted by hand labor, and carried 3 to 6 miles on the backs of llamas, to primitive smelters, whence the silver bullion was transported by llamas 200 miles to Lima, until circa 1870, when the railroad was completed to Oroya.

Authorities disagree hopelessly as to the geology of the district. All that can be said with certainty is, that in an area approximately one mile wide and between one and two miles in length, there is ore on nearly every claim, proving the Cerro de Pasco one of the richest mineral deposits of the globe. The ores carry gold, silver, copper, cobalt and other metals, values being found in two zones, the upper carrying mainly silver, in quantities from a few ounces to thousands of ounces per ton, in decomposed quartz. Considerable gold is found in the upper zone, this running as high as 1 oz. to 2 oz. per ton, occurring in rich but erratic chutes. The silver values usually extend to about 100′ depth, followed by silver-copper ores, and they, in turn, at a little greater depth, by copper-silver ores. All of the copper ores are more or less argentiferous, being estimated to average 15 oz. to 35 oz. silver per ton, and practically all of the copper ore is bismuthiferous also, hence highly refractory in reduction. In the past only the richest copper ores have been worked, those shipped ranging from 25% to 40% in tenor. Claims advanced that the ores of the district, will average 25% copper are entirely unwarranted, as the high-grade ore shipped was carefully hand-selected, owing to excessive transportation charges. The copper ores grow leaner with depth, as in other districts, below the permanent water level, at about 250′. In but few cases have any of the old mines been opened to depths of more than 200′, while the great majority are less than 100′ in depth.

The lands owned by the company at Cerro de Pasco are in a compact tract, lying in a basin, hence tunneling is impracticable, unless a very long tunnel be driven. There are but three attempts of this sort, the only one of importance being the Rumaillana tunnel, begun 1887, by Henry Meiggs, and discontinued, because of his death, at a distance of 1,000′. Meiggs held a concession from the Peruvian government for 25% of the gross values extracted by mines drained through this tunnel. This concession is now held by a company, which has cleaned out the old heading and driven the tunnel to length of 1,466′. There is a possibility of litigation between the Cerro de Pasco and this corporation, in case the latter completes the tunnel. The surface of the Cerro de Pasco tract shows many "tajos," big pits resulting from the caving-in of old open-cast workings.

The old mine workings, hundreds in number, have been disregarded, except as throwing light upon the geology and ore values of the property, and development of the present company is by five two-compartment shafts, modern pumps permitting the driving of mine openings below the water-level, and a modern metallurgical plant allowing the reduction of base ores that formerly were hopelessly unprofitable. Development has been pushed vigorously and methodically, the principal mines being known as the Diamante and Del Norte. Ore in sight is variously estimated at 2,000,000 to 75,000,000 tons, the latter

figure representing the possibility, rather than being an estimate based upon tangible data. That the ore bodies carry tens of millions of tons is a reasonable deduction from the developments of the olden days, supplemented by the work of the present company. Various new ore bodies have been opened, and several years' reserves have been blocked out. The ore in the new workings is divided into 3 grades, the first grade averaging 8% to 10% copper, with good silver values regularly, and high values frequently. Second-grade ore carries about 6% copper, with fair silver values, and the average copper tenor of the third grade is uncertain, but probably workable.

In addition to the regular mining work, considerable prospecting is in progress, on the main tract, and also in the adjoining districts of Vincuscancha, Quishuarcancha and Goyllarisquisca. As the diamond drill is used extensively for borings, it is to be hoped that the formation in these districts is not as hard as the names.

The smelter, at Tinahuarco, is 9 miles from the mines and connected therewith by rail. The smelter is designed as the first unit of a mammoth reduction plant, planned to be doubled, and possibly quadrupled, at later date. The furnaces have mechanical charge and the plant is automatic throughout, so far as possible, with the dual object of saving costs and rendering the works as little dependent as possible upon the ignorant native workmen, who must be employed for manual labor. There are four 56x180" Allis-Chalmers water-jacket blast-furnaces, of which three are in place and the fourth is on the ground for installation. These are rated by management at only 250 tons each, but should give a higher duty. The blast is furnished by 3 No. 11 Connersville blowers, delivering air at 40 oz. pressure. The converter department has 4 stands, with room for a fifth, blast being furnished by two 1,500-h. p. Nordberg air-compressors, each rated at a duty of 24,000 cubic feet of free air per minute, compressed to 17 lbs. pressure per square inch. For general power purposes there are two 475-h. p. Nordberg engines, direct-connected to two 350-kw. electric generators. Steam is supplied by Babcock & Wilcox boilers, of 4,000 aggregate horse power.

Ores are smelted raw, with charges of 5% to 10% limestone and 12% coke. The first furnace went into commission Jan. 7, 1906, and the second and third stacks were blown in during February. The fourth and last furnace was expected to be blown in about May, 1906. The beginning made was not an unalloyed success, the furnaces freezing up repeatedly. The altitude of 14,000', at which the smelter is working, may have had some effect, but a more probable cause is at hand in the inefficiency of the native labor employed at the smelter. It is probable that the preliminary troubles will be settled in a comparatively short time.

Coal mines owned by the company have been developed at Vinchuscancha, 17 miles from Cerro de Pasco, and are connected with the mine and smelter by rail. The coal is bituminous and cokes fairly well. A washery is to be built at the mines, and a coking plant with 72 beehive ovens is being built at the smelter. Pending the utilization of its own fuel, the company is burning Australian coal at the mines, and English coke in the smelter

The mine is served by the Cerro de Pasco railway, built by the Cerro de Pasco Railway Co., closely affiliated with the Cerro de Pasco Mining Co., under a government concession. This line runs about 80 miles from Cerro de Pasco southward to Oroya, and 17 miles northward to the company's coal mines. Including the main line, spurs and sidings, it will have circa 125 miles of track. The company is said also to have under consideration the extension of this line past the coal mines, through a very rugged country said to be rich in copper and silver. The line has an average grade of 1.5%, with a maximum grade of 3%, and has cost upwards of $2,000,000. At Oroya connection is made with the Central Railway of Perú, running 130 miles to Callaó. In this distance the line, which cost $43,000,000, gains nearly 3 miles vertical elevation, reaching the highest altitude of any railroad on the globe, after surmounting almost incredible obstacles, having an average grade of 2.5% and passing through no less than 57 tunnels, including the Galera tunnel of one kilometer length, which cuts through a ridge of the Andes. Despite its high average grade, it has been necessary to build many switchbacks.

Wages are $2.50 to $4 per day for white labor, and 25 cents to 50 cents per day for natives. The latter are tractable and for some purposes fairly efficient. The company employs about 6,000 men, of whom 100 are Americans and Britons, the balance being natives.

The Cerro de Pasco probably is the most expensive copper proposition ever developed. Other mines have expended more money but most of it came from earnings, while the Cerro de Pasco mines, smelter and railroad have cost probably between $10,000,000 and $12,000,000, to the point of production, and much work remains for the future. The policy of the mine is one of expansion, and as the management is experienced and capable, as well as of great financial strength, it seems probable that the smelting troubles will be overcome, as the other difficulties have been in the past, and that the Cerro de Pasco, which should be a considerable producer during 1906, will become, eventually, one of the world's largest copper mines.

CERRO DE PASCO TUNNEL & MINING CO. **PERÚ.**

Office: 45 Wall St., New York. Eleanor Rawles-Reader, president and secretary; C. A. Neville, vice-president; H. N. Carter, treasurer. Organized August 8, 1902, under laws of Maine, with capitalization $12,000,000, shares $10 par, half in 7% cumulative preferred, and half in common stock. Lands, 196 hectareas, about half in the Yauli district and half in the Acari district, latter 37 miles from Lomas. Is supposed also to have, or to have had, an option on the Ramaillana or Meiggs tunnel, in the Cerro de Pasco district. Was promoted by Eleanor Rawles-Reader, a lady-financier who obtains much notoriety in the press, which expatiates lovingly upon her beauty and magnetic temperament, and bears down lightly upon the question of the success—or otherwise—of her various promotions.

CERRO MURIANO MINES, LTD. **SPAIN.**

Offices: 5, Queen Street Place, London, E. C., Eng. Mine office: Manriques 9, Córdoba, Spain. Employs 160 men. Wm. Frecheville, chairman: John Taylor & Sons, managers; F. H. Williams, secretary; Richard E. Carr,

British vice-consul at Córdoba, agent; Joseph Tamblyn, mining captain. Organized May 7, 1903, and capitalization increased, 1905, to £235,000, shares £1 par; issued, £143,220.

Lands, 314 hectares, area 776 acres, in the districts of Córdoba and Obejo, held under perpetual lease from the State, also sundry leasehold tracts. Property shows sundry old mines, which were worked during the era of Roman domination, to a depth of at least 400′, notwithstanding their wetness. Property shows 6 large and several small fissure veins in micaceous schists, diorite and quartzite, carrying chalcopyrite and iron pyrites, with a gangue of calcite, quartz, clay and country rock. Veins have widths of 1′ to 40′, with following lengths: Calavera, 1,635′; Excelsior, 635′; Lorenzo, 4,575′; Isabel, 5,550′; Cerro Muriano, 8,500′. Ore taken from old Roman workings has assayed 28% to 34% copper.

Main shafts are the Santa Victoria and San Rafael, 300 metres apart. The San Rafael is 917′ deep and very wet. Crosscuts have been driven at depths of 100, 132, and 154 metres, each level showing a vein of 5 to 13 metres width, with the better portions worked out by the Romans. The San Rafael shaft has been enlarged and is the main pumping shaft, equipped with a Hawthorne-Davey Cornish pump having a 54″ high-pressure cylinder with 96″ stroke, and a 94″ low-pressure cylinder, with 16′ stroke. The pump is calculated to operate to a depth of 1,580′, and is giving excellent results. The San Rafael is drifting on the 820′ level and is said to have ore of fair grade thereon.

The Santa Victoria shaft is bottomed in the footwall at 726′, and is drifting on the 706′ level. The San Guillermo shaft suspended sinking at 42′.

Surface equipment includes 3 steam hoists and a 10-drill Walker air-compressor. The Ferrocaril Andaluces passes over the property, and a railway station has been built near the San Rafael shaft. Credit for the reopening of this old property belongs to Mr. Carr. The developments are of a favorable nature, and at the end of 1905 the mine had about 25,000 tons of 4% ore blocked out. This is one of the lagest and most interesting of the old Hispano-Roman mines, and was famous, before the Christian era, for the high quality of copper and brass produced from its ores, but was entirely idle for some 2,000 years, until reopened by the present owners.

COMPAÑA MINERA CERRO VERDE, S. A. **MEXICO.**

Is the Mexican corporation of the San Xavier Copper Co.

SUCESION CERVERO. **CHILE.**

Office and mine: Petorca, Aconcagua, Chile. Operates the Cabildo mine, opened 1886, producing the equilvalent of 800 tons fine copper yearly, shipped as matte. Also owns the following old mines, at Nipa and Coligue; Montoya, opened 1855, developed by a 900′ tunnel; Castillo, opened by a 400′ shaft; Quisco, opened by a 300′ shaft, and Cuevas, opened by a 120′ shaft. Employed about 250 men, at last accounts.

CETINI MINE. **ITALY.**

A comparatively new mine, near Pisa, in the Volterrano district of Italy, with occurrence and nature of ore similar to the Montecatini. Is a small producer of copper.

CHAFFEE GOLD & COPPER MINING CO. **COLORADO & WYOMING.**

Mine office: Black Hawk, Gilpin Co., Colo. S. N. Cravens, president; G. W. Doverspike, vice-president; H. R. McClellan, secretary and treasurer. Organized September, 1901, with capitalization $100,000, shares 10 cents par. Is out of debt, but without funds. Lands, 5 acres, known as the Telephone claim, 1¼ miles from Black Hawk, opened by a 100′ tunnel, said to show a 6′ vein. Also has 80 acres, undeveloped, near Tie Siding, Albany county, Wyoming.

CHALCHIHUITES MINES CO. **MEXICO.**

Office: 288 Garside St., Newark, N. J. Mine office; Chalchihuites, Zacatecas, Mexico. Edw. H. Jones, president; C. C. Hamer, secretary; B. W. Farris, general manager. Lands, 192 pertenencias, including the San Nicolás mine, carrying ores of gold, silver, copper and lead. Is opened by shaft and equipped with steam power, employing about 40 men at last accounts.

CHALLENGE MINE. **MICHIGAN.**

Owned by Mary's Mineral Land Co.

CHAMPION COPPER CO. **MICHIGAN.**

Office: 27 State St., Boston, Mass. Mine office: Painesdale, Houghton Co., Mich. Mill office: Redridge, Houghton Co., Mich. Employs circa 900 men. Wm. A. Paine, president; Arthur G. Stanwood, vice-president; preceding officers, Samuel L. Smith, Chas. H. Paine, Geo. P. Gardner, Richard Olney and Nathaniel H. Stone, directors; Frederic Stanwood, secretary and treasurer; F. W. Denton, general manager; John Jolly, underground superintendent; Richard Trevarrow, mining captain; F. G. Coggin, mill superintendent; R. H. Leach, assistant mill superintendent; M. J. Harrington, chief clerk; H. F. Mercer, chief engineer; W. E. Campbell, master mechanic; Mark Cunningham, superintendent of motive power. Organized December, 1899, under laws of Michigan, with capitalization $2,500,000, shares $25 par. Entire stock issue is owned jointly by the Copper Range Consolidated Co. and St. Mary's Mineral Land Co. The Champion Copper Co. owns $44,000 stock of the Michigan Smelting Co. Dividends were $300,000, in 1903; $200,000 in 1904 and $1,000,000 in 1905. The company earned, 1905, over all expenditures, $976,770.87, and closed the year with a cash surplus of $140,526.

Lands, 1,240 acres, consisting of the south half of Section 30; west half and north half of northeast quarter and southwest quarter of northeast quarter of Section 31, Town 54 North, Range 34 West; southeast quarter of Section 25 and east half of Section 36, Town 54 North, Range 35 West, practically all on the mineral belt. Neighbors of the Champion are the Copper Range and Trimountain on the north, lands of St. Mary's company and Hussey, Howe & Co. on the east; Hussey-Howe lands and the Globe property on the south and the Copper Range tract on the west. The tract gives a distance of 9,047′ on the strike of the lode, and at the present angle of dip, the deepest shaft could go down 18,950′, before reaching the company's boundary line on the west.

Development was begun in 1899, under direction of Dr. L. L. Hubbard, and three parallel amygdaloids were uncovered by trenching, one of which, the Baltic lode, showed phenomenal copper values. The two amygdaloids paralleling

the Baltic lode show copper in sufficient quantities to render their future exploration advisable. A fourth amygdaloid, about 15′ wide, discovered 1901, east of the Baltic lode, carries heavy copper to a promising extent, and there also is a fissure vein of arsenical ore, apparently algodonite, near "C" shaft. The width of this vein at surface is slight, and mineral contents variable, but on the second level the fissure is 2′ wide and well mineralized.

The dip of the Baltic lode at the Champion is about 70°, with about the same strike as at the Trimountain, rather than the exaggerated easterly trend noted at the Baltic mine. The bed runs 13′ to 45′ and averages 24′ width, carrying more epidote than at the Trimountain and Baltic. The surface of the tract is very hilly, but the overburden is less than is found either to the northward or southward. The stretches of lean ground in the mine are few, and the lode carries heavy copper in profusion, mostly in barrel size, but running up to masses of 10 tons in weight.

The mine is developed by 4 shafts, numbered from north to south, with room for 4 shafts.

"A" is merely the site of a possible future shaft.

"B" shaft, the northermost, is 1,835′ south of the Trimountain boundary, with collar 635′ above mean water datum of Lake Superior, and at the close of 1905 was 1,040′ deep.

"C" shaft is 1,050′ south of "B," 616′ above the lake, and 1,000′ deep.

"D" shaft is 1,300′ south of "C," 621′ above the lake, and 1,105′ deep.

"E" shaft is 1,300′ south of "D," 3,900′ north of the Globe boundary, and is 1,104′ deep.

"F" shaft, 1,300′ south of "E," was abandoned, because of the treacherous overburden.

All four shafts were deepened during 1905, and are connected on the upper levels. The mine has about 7 miles of lateral openings. The Baltic lode shows so little poor ground in the Champion mine that it is probable that eventually nearly every level will be opened from end to end of the mine, giving the longest average levels opened in any Lake Superior property, if not in the world. The only really poor ground shown in the mine was at "E" shaft, in the second and third levels, but the mineralization is regular and satisfactory below the fourth level. The mine shows some stopes that are phenomenal for width and richness.

The shafts have duplicate combination 40x50′ rockhouses, each equipped with a steam-hammer for heavy copper, one 12x15″ and two 18x24″ crushers, engines and storage-bins, "D" shaft having one extra 18x24″ crusher. The old equipment included hoists at each shaft good for 1,500′ depth. The permanent equipment was placed at "D" shaft in 1905, this including a Nordberg hoist having 24x60″ duplex cylinders and double conical drum with maximum diameter of 14′ and capacity for two 3,000′ cables. The engine-house at "D" shaft is of mine rock, with redstone trimmings and the boiler-house adjoining has a battery of Burt locomotive firebox boilers. A new coal-trestle, entirely enclosed, was built at "D" shaft in 1905. "E" shaft is to have a permanent hoist in 1906, which will be a duplicate of the one at "D" shaft.

The principal mine buildings are located about a quarter mile south of "E"

shaft. A ravine has been dammed, impounding about 12,000,000 gallons of water for boilers, the dam being 30′ from hardpan foundation to crest, with a cement core 5′ at the bottom and 2′ at the top, reinforced by rock. The machine-shop, 60x144′, of sandstone with slate roof, has a traveling crane and trolley-rail for its entire length, and is equipped with a complete line of shop tools, power being supplied by a 30-h. p. electric motor. Standing beside the machine-shop, and also of red sandstone, is the 50x128′ smithy, which has a trolley rail for handling forgings, running the entire length of the shop. Both machine-shop and smithy have railroad tracks connecting with the Copper Range road. The carpenter-shop, of wood, with iron roof and siding, is 32x60′ in size.

The main compressor building, at "F" shaft, is of steel, housing a 100-drill Nordberg quadruple expansion two-stage air-compressor, with capacity to compress 9,120 cubic feet of free air per minute to a pressure of 70 lbs per inch. The compressor, operates at a steam pressure of 280 lbs. and has a regenerative feed-water system. Power is furnished by three 250-h. p. Geary water-tube boilers. At "B" shaft is a 40-drill Ingersoll-Sergeant cross-compound two-stage air-compressor, with vertical receiver intercooler. The electric light plant, with a 100-kw. generator, is in the main compressor building. The power plant at "F" shaft has 3 Bradley boilers, operated at 250 lbs. steam pressure, and a coal-bunker with railroad tracks on trestles, having a tunnel below each trestle, coal being drawn, as required, through hatches into hopper-cars in the tunnel, these passing over an inclined track into the boiler-house, saving much labor in the handling of fuel. There is an automatic telephone system, with 30 stations, connecting the principal buildings and a number of pump-stations underground. Annual coal consumption, at mine and mill, is about 20,000 tons.

The company owns a good office building, two miners' changing houses, warehouses, stables, three large boarding-houses and 244 substantial dwellings. The attractive townsite is called Painsedale, and in addition to the company's buildings has a hotel, schoolhouse and several business houses. The Sarah Sargeant Paine memorial library, a handsome red sandstone structure costing $30,000, was erected by Wm. A. Paine, president of the company, as a memorial to his mother, and is much appreciated by the company's employes. The water system, serving the mine and town jointly, has a 1,000,000-gallon electric pump at Lake Perreault, 4½ miles distant, and a 200,000-gallon steel stand-pipe on high ground near the mine.

The stamp-mill, at Freda, on Lake Superior, about two miles west of Redridge, is 215x266′, of steel and concrete, built by the Wisconsin Bridge & Iron Co. The original mill has 4 Nordberg stamps, each with a 15′ concrete foundation, and an addition of 88x215′, completed 1905, is used for new crushing machinery. The mill has cement floors in the wash-room. The wash for the four heads has Hodge graduated adjustable-speed jigs, with plungers working simultaneously or alternately, in pairs, also 40 Overstrom tables. The addition has space for two stamps, with washing machinery, and is occupied by an experimental unit, that employs crushers instead of stamps. Rock is fed automatically from bins to a gyratory crusher, passing over a belt-conveyor, whence barrel copper is hand-picked. The

rock passes thence to very large jigs, with sieves made of punched
Material from the first jigs passes through successive sets of rolls and ji
reducing the material in size, and each constituting a complete concen
unit. The advantage of this system is the extraction of copper without
essary pounding under the stamps, and the extraction of the heavier co
the earlier stages of jigging. The copper is secured in rough form, a
"horns," as in the mine, whereas the heavier copper from the stam
emerges as rounded pebbles. The new crushing plant obviates consider
the heavy sliming inseparable from the use of steam stamps. Losses u
old plan of milling slightly exceed 0.3%, and the new crushing plant a
loss of less than 0.3%. A Hancock jig is to be installed, in 1906, for expe
tal purposes.

In the older mill, all heads were cross-compounded June, 1903, but t
periment did not prove a success commercially, although theoretically it
considerable step in advance. Could all four stamps be operated sim
neously and regularly, the cross-compounding doubtless would effect a s
in fuel costs, but in ordinary practice it has been found preferable to hav
stamping unit independent. Regrinding of raggings is done by Allis-Ch
crushing rolls, having one roll in a fixed bearing and the other with a
adjustment. The preliminary discharge from the stampheads is treat
very large jigs having 30x48" sieves of punched steel, with one-eighth
openings, installed in connection with the head. Each head has two s
tanks, the first 8x8' and 3' deep, with "V" bottom, connected by a
shaped apron with the second tank, 16x16' with a "W" bottom. Ve
of flow of slimes is 10' per second in the first, and only 1' per second i
last tank. Pulp is withdrawn through spigots at the bottom of each tan

The mill is heated by hot water from a Green fuel economizer, pipe
300° to 350° F. to a steel-clad chamber, whence heated air is drawn into
by a Sturtevant blower and distributed through the mills, the water
pumped back to the economizers and thence fed again to the boilers.

The steel boiler-house, remodeled 1905, has four 200-h. p. Stirling bo
and 5 Dutch oven Scotch marine boilers, latter maintained in reserve. A
matic stokers were tried, but have been discarded. Coal is brought to
boilers by gravity-tram and reduced to uniform size by a grinder before fe
to the grates, and ashes are washed into the lake through a launder, by je
water. Exhaust steam passes through dry condensers, thence to a hot-
from which water is fed to the boilers at a high temperature.

A 20,000,000-gallon Nordberg triple expansion pump is housed in a 4
steel pumphouse, with truss roof and traveling crane. Water for the mill
boilers comes from the lake, through a 1,020' tunnel, the shore end b
ing a well with bottom 8' lower than the lake level, this being the longest tu
ever driven under Lake Superior. The intake crib has a free area of 45 sq
feet, and with a second crib the tunnel could furnish water for 8 to 10 str
Water cost is less than 1½ cents per ton of rock stamped.

The warehouse, office and laboratory at the mill were burned August

1905, but have been replaced. The milling plant has machine, carpenter and blacksmith shops, a fire-pump and water mains, with a five hydrants, a private telephone system and about 20 dwellings for employes.

At the close of 1905, rock production was approximately 2,000 tons daiiy and is to be increased. Only about 15% of the lode rock broken in the mine is discarded. In 1905 the mill stamped 604,483 short tons of rock, producing therefrom 22,651,541 lbs. mineral, from which was smelted 15,707,426 lbs. fine copper, giving an average yield of 25.98 lbs. fine copper per ton. Total cost of fine copper, including construction account, was 9.34 cents per pound.

The Champion is one of the largest and richest of the Lake Superior mines and has been admirably handled from the beginning. Among the amygdaloid mines of the district the Champion is second only to the Quincy in production, and second only to the Wolverine in richness. The mine has by no means reached its ultimate limit of output, and should show a steady increase in production for some years to come, with bright prospects of becoming the largest and most profitable amygdaloid mine of the district.

CHAMPION GOLD & COPPER MINING CO.

Office: California Blk., Tacoma, Wash.

CHAMPION COPPER MINING CO. **IDAHO.**

Letter returned unclaimed from former mine office, Mullan, Shoshone Co., Idaho. Lands, sundry claims, just east of the Park mine, on the southern slope of Stevens Peak, 4 miles south of Mullan, opened by 2 tunnels, longest 600', on a vein ranging up to 25' width, carrying chalcopyrite assaying about 5% copper, with quartz and calcite gangue.

CHAMPION MINING CO. **IDAHO.**

Office: care of Edward R. Hall, president, Marquette Bldg., Chicago, Ills. C. T. Mixer, vice-president and manager; R. T. Badger, secretary and treasurer. Organized 1905, with capitalization $100,000, shares 10 cents par, to develop claims in the Alder Creek district of Custer county, Idaho.

CHAMPLAIN MINING CO. **IDAHO.**

Letters returned unclaimed from former mine office, Doniphan, Idaho.

MINA LA CHAPARRITA. **SPAIN.**

Mine office: Nerva, Huelva, Spain. A group of 11 old mines, area 106 hectareas. A little copper is produced, by cementation, from the mine waters.

CHAPPELL MINE. **VIRGINIA.**

Owned, at last accounts, by Howard Mining Co.

CHARLOTTE & CONSTANCE MINES. **NEW CALEDONIA.**

These properties, in the neighborhood of Bonde, New Caledonia, show large outcrops, and have been described by the French authorities as mountains of ore, but it cannot be learned that any serious attempts at development have been made.

CHARM & COPPERHEAD GROUPS. **UTAH.**

In the Drum Mountain district of Utah. Are sometimes known as the Busby & Clive properties. The Charm group is said to have considerable ore blocked out, and to carry good values in copper and gold. Presumably idle.

CHARTER OAK COPPER MINES, LTD. — **BRITISH COLUMBIA & WYOMING.**

Offices: 16, Victoria St., London, S. W., Eng. Sir H. Seton-Karr, chairman; T. Toten Willcox, secretary. Organized June 22, 1898, with capitalization £40,000, shares £1 par; issued, £28,957. Lands, 2 claims in British Columbia, also 89 acres in Carbon county, Wyoming, latter under bond and lease to the Copper Bar Mining Co.

CHASE CREEK COPPER CO. — **ARIZONA.**

Mine office: Clifton, Graham Co., Ariz. Clarence K. McCornick, president; H. G. Smith, treasurer; S. S. Campbell, manager; I. N. Stevens, superintendent. Capitalization, $5,000,000. Lands, 52 claims, area, 1,040 acres, circa 8 miles west of Clifton, well located next to producing mines. Development is by a 6x8′ tunnel of about 600′, on lands adjoining the Longfellow mine. Main tunnel cut the Longfellow ore body, of concentrating grade, at a distance of 493′, and can be driven to obtain a 2,000′ back. Tunnel has a single track, practically reaching the Coronado railroad, which will allow advantageous shipments. Management is good and property is regarded as promising.

CHATHAM COPPER CO. — **NEW MEXICO.**

Mine office: Silver City, Grant Co., N. M. J. W. Carter, assignee. Lands include the Virginia mines, in the Burro Mountains, and a smelter at Silver City, blown in May, 1904, and quickly blown out again. Property idle, and company insolvent.

CHATTERTON MINING CO. — **COLORADO**

Mine office: Pearl, Larimer Co., Colo. Is said to own the Kurtz-Chatterton mine, also claimed by the Kurtz-Chatterton Copper Mining Co., and both corporations are controlled by the National Mining & Milling Co.

CHATTERTON MINING CO. — **MEXICO.**

Mine office: Talpalpa, Jalisco, Mex. N. W. Kinross, general manager. Mining property is the San Antonio y Anexas, said to have been bought, 1905, of Silviano Camberos, et al, of Guadalajara, for $100,000.

CHAUTAUQUA MINING CO. — **CALIFORNIA.**

Office: Jamestown, N. Y. Letter returned unclaimed from former mine office, Manvel, San Bernardino Co., Cal.

CHAVEZ MINE. — **NEW MEXICO.**

Mine office: Riley, Socorro Co., New Mexico. A prospect only. Idle.

CHELAN COPPER CO. — **WASHINGTON.**

Mine office: Chelan, Chelan Co., Wash. Said to own the Texas Jack copper claims, in Upper Horseshoe basin, Washington. Vein is claimed to be 30′ between walls, in places, with a paystreak of about 20″, carrying copper and silver values. Idle.

CHELAN TRANSPORTATION & SMELTING CO. — **WASHINGTON.**

Office: Chelan, Chelan Co., Wash. R. D. Johnson, general manager. Has an electric line to the Holden mine, and is said to have a smelter. Presumably idle.

CHENIUS FALLS COPPER MINING CO. — **WASHINGTON.**

Mine office: Fairfax, Pierce Co., Wash. Organized July, 1902, with capi-

talization $1,000,000, by F. C. Robinson, et al, of Spokane, Wash. Lands, 2 claims, on the Chenius river, circa 7 miles from Fairfax. Idle.

CHEROKEE COPPER MINING CO. **WYOMING.**

Office: care of Harry Stone, care of Bernard McCaffrey, Equitable Bldg., Denver, Colo. Mine office: Encampment, Carbon Co., Wyo. Apparently moribund.

CHETICAMP COPPER CO., LTD. **NOVA SCOTIA.**

Office: 37 Sackville, St., Halifax, N. S. Mine office: Cheticamp, Inverness Co., N. S. Employs 20 men. John Stewart, president; Edward Stairs, vice-president; A. B. Crosby, second vice-president; John W. Regan, secretary and treasurer; Milton V. Grandin, superintendent; W. H. Strachan, auditor. Organized 1904, under laws of Nova Scotia, with capitalization $2,000,000, shares $1 par, as successor of the Eastern National Copper Co. and three other corporations. Lands, 150 acres, also a 200-acre mill and smelter site, 1,000 acres timber lands and 200 acres water frontage, on Cheticamp Harbor. Company also has a government license for exploring and locating mines on 50 square miles of territory.

Country rocks are micaceous schists, with ores carried in a mineral zone of 350′ width by 1½ miles length, this showing 14 ore bodies, of which 3 are undergoing development, these being opened by a 200′ shaft and by tunnels of 25′, 30′ and 115′, claimed by company to show 250,000 tons of ore averaging 2.5% to 3.5% copper, 18% lead, 30 oz. silver and $2 to $30 gold per ton, from exclusively sulphide ore. Nearest railroad is 38 miles, but an extension is being built to within 5 miles. Property is 5 to 6 miles only from tidewater. Company plans sinking main shaft to 250′, sinking a parallel shaft 1,000′ distant, and connecting the two. Stock issued for properties in consolidation is in escrow until 1907. Management seems good and property is regarded as promising.

CHEWELAH COPPER KING MINING CO. **WASHINGTON.**

Office: care of S. P. Domer, general manager, Spokane, Wash. Mine office: Chewelah, Stevens Co., Wash. J. H. Long, president; J. D. Blevins, superintendent. Mine has been under steady development since circa 1896, and has a 1,300′ main tunnel, showing an ore body of 30′ to 40′ width, carrying auriferous and argentiferous copper sulphides, averaging $6 to $9 per ton in total values. Ore is transported 4½ miles to Chewelah by a 125-h.p. traction engine hauling 5 ten-ton cars, and is shipped from bunkers by rail to the Granby smelter.

CHIAPAS MINING CO., LTD. **MEXICO.**

Voluntarily liquadated, August, 1904.

CHICAGO-ALGOMA NICKEL CO. **ONTARIO.**

Letter returned unclaimed from former mine office, Sudbury, Algoma, Ont. Lands, sundry claims, opened by shafts, showing cupriferous and nickeliferous pyrrhotite.

CHICAGO & ARIZONA MINE. **ARIZONA.**

Letter returned unclaimed from former mine office, Dos Cabezos, Cochise Co., Ariz. Thos. D. Chattman, president; P. B. Soto, secretary-treasurer.

Capitalization $200,000, shares $1 par. Lands, 210 acres. Has an ore bo apparently of good size, giving assays of $7 to $20 per ton, in copper, silver a gold. Property was under bond to John Brockman, at last accounts.

CHICAGO-BRITISH COLUMBIA MINING CO. BRITISH COLUMBI

Mine office: Greenwood, B. C. Wm. L. Springer, president; Nicho Kuhnen, treasurer; Geo. W. Raithel, secretary; H. H. Shallenberger, manag Organized 1901, with capitalization $2,000,000, shares $1 par. Lan 177 acres, about midway between the Granby and British Columbia min opened by a 165′ two-compartment vertical shaft, with 75′ of crosscuts, exp ing good ore. Has steam power and a 6x8″ Jenckes hoist. Presumably id

CHICAGO COPPER CO. COLORAD

Mine office: Salida, Chaffee Co., Colo. Chas. Peck, manager. Lands, claims, showing ore giving good assays. Presumably idle.

CHICAGO COPPER REFINING CO. ILLINOI

Office and works: Blue Island, Cook Co., Ills. Company has a sm smelter and makes a specialty of refining copper ores rich in gold and silver, a also handles copper ores and mattes containing platinum and other ra metals.

CHICAGO-LA SAL GOLD & COPPER CO. UTA

Letter returned unclaimed from former mine office, La Sal, Utah.

CHICAGO & KOOTENAY MINING CO. BRITISH COLUMBI

Letter returned unclaimed from former mine office, Hall, B. C

CHICAGO MINING & MILLING CO. UTA

Office: care of Fred T. McGurrin, secretary, Salt Lake City, Uta Thos. Keeley, president. Organized 1904, with capitalization $150,000, shar $1 par. Lands include the Wild Bill group of claims, in Beaver count Utah. Presumably idle.

CHICAGO NICKEL CO. ONTARI

Lands, sundry prospects in Drury township, Algoma district, ne Worthington, Ontario, showing copper-nickel-iron ores. Moribund.

CHICAGO & PATAGONIA COPPER & GOLD MINING CO. ARIZON

Office: 97 Clark St., Chicago, Ills. Mine office: Nogales, Santa Cruz Co Ariz. Organized January, 1904, with capitalization $250,000, by Joseph Ko zeniewski, et al. of Chicago. Lands presumably are in the Patagonia district.

CHICAGO-VENTURE MINING CO. WYOMIN

Office and mine: Encampment, Carbon Co., Wyo. Robt. H. Youn president and general manager; S. A. McCoy, secretary and treasurer. Organ ized 1901, under laws of Wyoming, with capitalization $1,000,000, shares $ par. Lands, 5 patented claims, area 100 acres, showing two fissure veins i Limestone, near a grano-diorite contact, of which one, averaging 15′ width, developed by shafts of 60′ and 200′, and by tunnels of 50′ and 60′. Idle f several years.

CHICAGO & YELLOW METALS MINE. WASHINGTO

Mine office: Spirit Lake, Skamania Co., Wash. Lands, circa 20 claim showing gold-copper ores, on the extension of the Norway-Sweden-Denmar belt, of Mt. St. Helens, in the valley of the North Toutle river.

CHIHUAHUA COPPER CO. **MEXICO.**

Office: 267 Central St., Lowell, Mass. Mine office: Moctezuma, Chihuahua, Mex. C. M. Dickey, president; Joseph Jackson, vice-president; Clarence W. Hoyt, secretary and treasurer; Morris B. Parker, superintindent. Organized November 7, 1905, under laws of Maine, with capitalization $600,000, shares $1 par. Annual meeting, second Tuesday in November. On April 1, 1906, was without debt or liability, except an unaccrued payment of $15,000, being the balance on purchase price of property, and had on hand $10,585.86 cash, with $24,363 due the company. Stock sales were suspended February 2, 1906.

Lands, 100 pertenencias, in the Bravos district, in the Sierra Mojena Mountains 20 miles west of Moctezuma. Property shows a large number of contact veins between limestone and porphyry, of which 4 are undergoing development, these ranging 2′ to 40′ in average width, and giving average assays of 8% copper, 3 oz. silver and $1 gold per ton, from cuprite, malachite, chalcopyrite and occasional chrysocolla. Developmentis by several shallow shafts, deepest 75′, and 9 short tunnels, longest 120′, with 650′ of underground openings, estimated to show 2,500 tons of ore, with 250 tons blocked out for stoping. Has a 25-h. p. hoist, good for 500′ depth, and a small Gardner air-compressor, with necessary mine buildings. Property was a small producer in the past, but was tied up by litigation for some time, before secured by present owners. Company plans continuing development steadily, and shipped sufficient ore, in the first three months of 1906, to pay for the small machinery plant on hand, and all development work. Company is not a promotion scheme and has done no advertising. Management and property are regarded favorably.

CHILCAT GOLD & COPPER CO. **ALASKA.**

Mine office: Haines, Alaska. Lands, 168 claims, on the Big Salmon river.

J. K. CHILD & CO. **BOLIVA.**

Office and mines: Coro Coro, La Paz, Bolivia. Firm operates mines of native copper in the conglomerate strata of Coro Coro. Annual production is about 600 tons of barillas de cobre (unsmelted copper mineral), averaging circa 80% in copper tenor. Employed circa 200 men at last accounts.

SOCIEDAD CHILENA DE FUNDICIONES. **CHILE.**

Letter returned unclaimed from former office, Santiago de Chile. Mine and works office: Tongoy, Ovalle, Chile. At last accounts operated the Tongoy mine, opened 1860, making about 700 tons of refined copper yearly, also the Guayacan mine, opened 1856, producing about 800 tons annually. Has smelting plants at both mines, and buys custom ores.

SOCIEDAD UNIÓN MINERA CHILENA. **CHILE.**

Mine office: Cobija, Tocapilla, Antofagasta, Chile. Operates the Condesa and Union mines.

CHILI COPPER CO., LTD.

Registered in Guernsey, March 4, 1905, with capitalization £400,000, shares £1 par. Apparently a wildcat.

CHILI COPPER SULPHATE SYNDICATE, LTD. **CHILE.**

Offices: 101, Leadenhall St., London, E. C., Eng. J. E. G. Hadath, secretary. Lands are leased to Copaquire Copper Sulphate Co., Ltd.

CHITTNA EXPLORATION CO. **ALASKA.**

Bankrupt. Property claimed is owned by Alaska Copper & Coal Co.

CHLORIDE GOLD MINING CO. **ARIZONA & CALIFORNIA.**

Office: care of J. H. Hoffman, Pueblo, Colo. Mine office: Chloride, Mohave Co., Ariz. L. Hoffman, manager. Property is the Samoa mine, a gold-silver-lead property, said to average $4 per ton in values, opened by a 300′ shaft. Company is said to plan leasing property to the Arizona Birmingham Gold Mining Co. Lands include the Iron gossan group, 11 claims in the northeastern corner of San Bernardino county, California, near the Nevada line, showing a strong iron capping, seamed with stringers of copper carbonates. The gossan gives average assays of 1.6% copper and is supposed to be the outcrop of a good copper vein.

COMPAÑIA MINERA y BENEFICIADORA DE METALES DE CHOIX, S. A. **MEXICO.**

Is the Mexican incorporation of the Choix Consolidated Mining Co.

CHOIX CONSOLIDATED MINING CO. **MEXICO.**

Office: 43 Wall St., New York. Business Office: 516 Grant Bldg., Los Angeles, Cal. Mine office: Choix, Sinaloa, Mexico. Employs circa 20 men. R. A. Thomas, president; Thos. E. Metcalf, vice-president; J. R. Thomas, secretary; J. A. Mackechnie, general manager. Organized May, 1902, under laws of Arizona, with capitalization $5,000,000, shares $1 par. Lands, 471 pertenencias, area 1,177.5 acres, also several mill and smelter sites, in the Choix district of Sinaloa and the Urique district of Chihuahua. Shipments of 1,062 tons of ore, December, 1900, to February, 1902, inclusive, to the Aguascalientes smelter, gave returns ranging from 19.5% up to 28% copper, with gross values of $127,915.44 and net values of $47,940.61. Lands are on both sides of the Fuerte river, and on the line of the Kansas City, Mexico & Orient R. R. now being built to Topolobampo, and at present only 30 miles from the mines. Ore bodies are said to measure from 50′ to 300′ in width, occurring as contacts between porphyry, diorite and limestone. Also has some gold mines, occurring as fissures in granite and quartzite. Properties include a number of antiguas, and when the railroad is completed to the mines, they should be able to produce to advantage. Ore shipped, 1900-1902, was packed on burros to Topolobampo, and sent thence to Guaymas by steam, thence by rail to Nogales and El Paso, and thence to the smelter at Aguascalientes, a distance of nearly 2,000 miles, notwithstanding which a fair profit was secured. Rail connections are hoped for soon, and it is planned to build a smelter. Lands are owned outright, and the company is free from debt. Property apparently is one of promise.

CHOTA NAGPUR MINES. **INDIA.**

At Chota Nagpur, Bengal, India. Were worked in very ancient days. Ore occurs as chalcopyrite, disseminated in schistose rocks. Idle since 1902-03, when a local company did a little development work.

CHTASTIE MINE. **BULGARIA.**

Office: care of MM. Stojanoff, Varbanoff & Co., Plevna, Bulgaria. Mine office: Belogradchik, Vidin, Bulgaria. Lands, 250 hectares, held under lease from the principality, showing 2 fissures averaging 30″ width and 600′ length,

carrying chalcopyrite assaying 18% copper, 8 oz. silver and 2 dwts. gold per ton. Has 3 shafts, deepest 260′, and 15 short tunnels, with about 5,000 tons of ore in sight. Presumably idle.

COMPAÑIA MINERA DE LA CIENGUITA, S. A. MEXICO.

Is the Mexican incorporation of the Cienguita Copper Co.

CIENGUITA COPPER CO. MEXICO.

Office: 1303-25 Broad St., New York. Mine office: Minas de Cienguita, Sahuaripa, Sonora, Mex. Employs about 400 men. Geo. Beebe, president and general manager; J. H. Wilhelm, vice-president; C. W. Wilhelm, secretary and treasurer; Frank Fitz, general superintendent; Jesse Scobey, assistant superintendent. Organized May 8, 1901, under laws of Arizona, with capitalization $10,000,000, shares $10 par; issued, $6,700,000. Was reincorporated, 1905, under laws of Nevada, and property transferred from the old to the new corporation, authority therefor being said by management to have been conferred by vote of 90% of the shareholders, but suit has been brought in the district court of Phoenix, Arizona, by some of the dissatisfied sharesholders in the old corporation. A portion of the stock issue of the old company also is in dispute.

Lands, 937 pertenencias, area 2,347 acres, circa 40 miles southeast of Sahuaripa, also about 30,000 acres of forest and grazing lands, all fairly watered and timbered. Lands include the Mina Real de la Tayapa, the Minas de las Cienguitas and the Ostimuri mines. Country rocks are granite, porphyry, diorite and quartzite, ores occurring in contact veins between granite and quartzite. Development is by shafts of 125′ and 136′ and by 18 tunnels of 35′ to 1200′, 6 being of 400′ to 1,200′ length each, giving about two miles of underground openings. Company estimates 2,000,000 tons of ore in sight, with 300,000 tons blocked out for stoping, which estimate is absolutely unwarranted. Veins are of practically vertical dip and 13 orebodies have been located, 5 of which are being developed, these ranging from 3′ to 60′ in width, being traceable 3 miles in length in one case, and are opened to depth of 800′ by one tunnel, the veins carrying sulphide ores claimed to give average values of 5% copper, 70 oz. silver and $3 gold per ton.

Equipment at the mine includes a 100-h. p. steam plant, with 6-drill air-compressor, 30x60′ stone machine-shop, assay office, store, miscellaneous mine buildings and 120 dwellings for employes.

Smelter, one-fourth mile from the portal of the principal tunnel, and receiving ore therefrom by tramline, has two 75-ton reverberatory furnaces and a 75-ton calcining furnace, producing matte averaging about 24% copper, 280 oz. silver and $12 gold. Ores are claimed to give smelter returns of 4.8% copper, oz. silver and $2.40 gold per ton. Fuel is inferior wood, costing $3 per cord. In March, 1906, one furnace in operation, was said to be treating 50 tons of ore daily. Expenses are about $10,000 per month, and company closed 1905 with a considerable cash balance on hand, and $18,000 due on the smelter. Mr. Wm. A. Farrish, who reported on the property, estimates that costs of mining and reduction should not exceed $7.50 per ton. The property is of value, but is poorly located as to transportation facilities, and company's estimates of ore reserves, production and profits are over-sanguine.

CINCINNATI CONSOLIDATED MINING CO.

Office: care of A. Hanauer, Jr., Salt Lake City, Utah. Lands are in county, Utah. Not a producer, and refuses to give any statement.

CIRCUMSTANCE GOLD & COPPER MINING CO. ARI

Mine office: Huron, Yavapai Co., Ariz. Presumably idle.

CITY ROCKS MINING CO.

Office: care of Jas. P. Edwards, secretary, Houghton, Mich. Mine Alta, Salt Lake Co., Utah. Robert L. Edwards, superintendent. Prop held under bond and lease by Messrs. Wm. S. Cleaves, James P. Edwa John Slockett, and payments have been made on the bond. Develop by tunnel, showing an 18′ ore body of exceptional promise. Property h duced $587,000 ore values in the past. Assays of 13% to 18% copp been secured. Plans shipping ore over the Continental Alta's 5-mile aeria

CLAIRE COPPER CO. I

Mine office: Montpelier, Bear Lake Co., Idaho. G. C. Gray, presid treasurer; A. D. Young, secretary. Organized Sept. 16, 1902, under l Idaho, with capitalization $200,000, shares 50c. par. Lands, 3 claims, acres, in an unorganized mining district of Bear Lake county. Veins o fissures in sandstone, and as contacts between limestone and porphyry, ores assaying 4.6% copper, 10 oz. silver and about $1 gold, from a 12′ v rying cuprite, melaconite, dioptase and chrysocolla, opened by tu 100′ and 200′. Presumably idle.

CLAIRMONT MINE. MONT

Mine office: Stevensville, Ravalli Co., Mont. Amos Buck & Co., own

CLARA COPPER CO. U

Letter returned unclaimed from former mine office, Thompsons, Utah.

CLARA GOLD & COPPER MINING CO. ARI

Mine office: Clara, Yuma Co., Ariz. J. E. Rodgers, manager. Lands, dry claims on Black Mountain, about 25 miles east of the Colorado river, ing a 30′ to 50′ vein carrying good gold values. Territory is to be o by the Arizona & California railroad.

CLARA MINING & SMELTING CO. MONT

Mine office: Butte, Silver Bow Co., Mont. Organized May, 1906, by D A. Grigg, John Crozier and Hugh Gillis, of Butte, with a paid-in capital, edly all in cash, of three dollars. This would be 20.000 reis, in Brazilian m

CLARA ST. DORA COPPER MINING CO. AUSTRA

Succeeded, 1897, by New Clara St. Dora Copper Mining Co. No Lia

CLARK CONSOLIDATED MINING CO. ARIZ

Letter returned unclaimed from former office and mine, Douglas, Co Co., Ariz. J. R. Clark, president; R. H. Skiles, secretary and treasurer; W. McIvens, manager. Lands, 10 claims, circa 10 miles east of Douglas, show veins of 3′ to 10′ width, carrying ores of copper, lead, silver and gold, assay up to 8% copper, with $30 to $35 gold, silver and lead per ton, opened by 60′ shaft.

CLARK MINE. MICHIG

Lands, circa 2,500 acres, lying south of Copper Harbor, Keewenaw coun

Michigan. Opened 1858, and idle many years. Total production 93 tons, 1,915 lbs. fine copper. Was owned by Edouard A. J. Estivant, Paris, France, but is now controlled by the Calumet & Hecla Mining Co., presumably by purchase in 1905, though possibly held under option. Was tested, 1905, by diamond drills.

KONIGLICHE HÜTTENAMT CLAUSTHAL. **GERMANY.**

Works office: Clausthal, Hanover, Germany. Herr Bergrat Boltze, manager. Property is a silver-copper smelter, operated under state auspices.

CLAYTON MINING & SMELTING CO. **IDAHO.**

Mine office: Clayton, Custer Co., Idaho. Lawrence Green, general manager Lands, 18 claims. Ores carry silver, lead and copper. Has water and steam power and a 50-ton smelter. Presumably idle.

CLEAR CREEK MINING & REDUCTION CO. **COLORADO.**

Mine office: Russell Gulch, Gilpin Co., Colo. F. R. Carter, superintendent. Property is the Saratoga mine, carrying gold, silver and copper ores. Has steam and electric power, and owns a pyritic smelter, at Golden, Colorado.

CLEOPATRA COPPER CO. **ARIZONA.**

Office and mine: Jerome, Yavapai Co., Ariz. Employs 15 men. Geo. W. Hull, president, treasurer and general manager; H. E. Wilcox, secretary. Organized 1902, under laws of Arizona, with capitalization $4,000,000, shares $1 par. Lands, 13 claims, 11 patented, area circa 200 acres, in the Verde district, showing sundry fissure and gash veins, of which several are being developed, these giving ores assaying 1% to 65% copper and 1 oz. to 500 oz. silver, with fair gold values. Has 6 shallow shafts, of 25′ to 150′ depth, and 9 tunnels, of which the 3 longest are 200′, 275′ and 1,750′, principal tunnels being known as the Dillon and Winningham, with a total of nearly one mile of underground openings, estimated by company to put 2,000,000 tons of ore in sight. Equipment includes steam plant with hoists and air-compressor, and necessary buildings. Material for 100-ton smelter was delivered January, 1906, and it was planned to have same in blast by July, 1906. Property seems well managed, and apparently is making fair progress.

CLEOPATRA GROUP. **CALIFORNIA & OREGON.**

Office: care of F. H. Osgood, Seattle, Wash. F. H. Osgood and J. S. Crawford, owners. Lands, 45 claims and a 40-acre millsite, in Del Norte county, California and Josephine county, Oregon. Slight development shows good ores, and native copper in masses up to several hundredweights. District is isolated and difficult of access.

CLEVELAND-ARIZONA MINING CO. **ARIZONA.**

Office: Tucson, Ariz. Mine office: Red Rock, Pinal Co., Ariz. Capitalization $350,000, shares $1 par. Lands, 10 claims, lying south of the Imperial mine, in the Silver Belt Mountains, within 7 miles of the Arizona Southern railway, in the Silver Belt or Ajo Basin district. Country rocks are granite, quartzite and limestone, with ore bodies occurring as contact veins, carrying sulphides at depths of 55′ to 150′. Gangue usually is granite and lime-porphyry. Developments are said to be of a favorable nature.

CLEVELAND GROUP. NEW MEXICO.

Mine office: care of Geo. H. Utter, Silver City Grant Co., N. M. Lands, 120 acres, 8 miles south of Silver City, on the west slope of the Pinos Altos Mountains, showing ores carrying copper, zinc, silver and gold. It is planned to begin shipments, 1906, to the Comanche smelter.

CLEVELAND & MONTANA MINE MONTANA.

Letter returned unclaimed from former mine office, Butte, Silver Bow Co., Mont. Lands were sundry claims in Leslie Gulch, opened by a 90′ tunnel.

CLIFF MINE. MICHIGAN.

Owned by Tamarack Mining Co.

CLIFTON-ARIZONA COPPER CO., LTD. ARIZONA.

Succeeded by Clifton Consolidated Copper Mines of Arizona, Ltd.

CLIFTON CONSOLIDATED COPPER MINES OF ARIZONA, LTD. ARIZONA.

Absorbed, 1903, by New England & Clifton Copper Mines of Arizona.

CLIFTON COPPER BELT MINING CO. UTAH.

Office: 24-65 West Second South St., Salt Lake City, Utah. Clyde H. Wilson, president; Frank L. Wilson, secretary, treasurer and general manager. Capitalization $25,000, shares 5c par. Lands are in the Deep Creek district of Utah. Has secured assays of 35.5% copper, 9 oz. silver and $1.20 gold per ton.

CLIFTON COPPER MINES, LTD. ARIZONA.

Office: 52 Wall St., New York. Lands, 8 claims, area 163 acres, lying east of the Standard mine. Is controlled by Standard Consolidated Copper Co.

CLIFTON COPPER CO. NEW MEXICO.

Office: Deming, N. M. Mine office: Santa Rita, Grant Co., N. M. J. L. Burnside, president; F. F. Rogers, secretary; M. M. Z. Elliott, superintendent. Organized 1900, with capitalization $500,000, shares $5 par. Lands, in the Central district of Grant county, were in litigation, but company secured a satisfactory settlement, October, 1903. Mine has 5 shafts, deepest 235′, showing an ore body, said to be 40′ to 50′ wide and a half-mile long, carrying oxide, carbonate and sulphide ores, with occasional native copper. Ore is of concentrating grade, with occasional high-grade paystreaks. Mine shows considerable ore ready for stoping. Has steam hoists and a 65-ton concentrator with 2 Huntington mills, 2 Wilfley tables and 2 Standard concentrators. Presumably idle.

CLIFTON COPPER MINING CO.

Presumably dead. A stock-jobbing scheme, promoted, 1898, by Julius Leszynsky, of New York.

CLIFTON TINTO COPPER MINES, LTD.

Voluntarily wound up, March, 1903.

CLIMAX GROUP MINING CO. WASHINGTON.

Office: care of E. W. Berry, 1203 Maxwell Ave., Spokane, Wash. Mine office: Baring, King Co., Wash. J. J. Browne, president; J. W. Douglas, vice-president; Frank P. Smith, general manager. Organized under laws of Washington, with capitalization $1,500,000, shares $1 par. Lands, 9 claims, area 180 acres, also a 20-acre millsite, in the Index district. Country rocks are granite and diorite, showing several contact veins, of which two

d by a 35′ shaft, two short tunnels and a 345′ tunnel, latter not
Ores are bornite and chalcopyrite, giving assays of 3% to 34%
oz. to 70 oz. silver, and from a trace to $6 gold per ton. Prop-
several seasons, except for assessment work, but management
suming operations during 1906.

INING CO. **COLORADO.**

office: Granite, Chaffee Co., Colo. B. H. Pelton, president. Prop-
Spondulix mine, carrying ores of gold, silver and copper.

MINING CO. **COLORADO.**

r returned unclaimed from former mine office, Ouray, Ouray,
Property was the Silver Link mine, carrying ores of gold, silver
r.

MINING CO. **WASHINGTON.**

: 501 Provident Bldg., Tacoma, Wash. Mine office: North Bend,
Wash. Employs 12 men. A. J. Weaver, president and general
W. S. Jackson, vice-president; A. R. Watson, secretary; R. C.
reasurer; Jas. R. Shearing, mine superintendent; A. Koberle,
Organized November, 1901, under laws of Washington, with
tion $2,500,000, shares $1 par. Title changed, circa 1905, from
ame of Sure Thing Gold-Copper Mining & Smelting Company.
claims, area 140 acres, also 2,900 acres miscellaneous lands, in the
trict, showing 7 fissure veins in granite, of which one, undergoing
ent, is reported by company to average 45′ width. Development
nels of 200′, 300′ and 600′, with 1,175′ of underground openings,
re reported by company to carry average values of 4.1% copper,
r and $2 gold per ton. These values are only a fraction of those
reported by the Sure Thing company, and probably are much
e truth. Has water power and hopes to secure rail connections,
ile line, on which it was planned to begin work April, 1906.

RRY COPPER SMELTING CO., LTD. **AUSTRALIA.**

eeded, 1895, by New Cloncurry Copper & Smelting Co., Ltd.

OPPER DEVELOPMENT SYNDICATE, LTD. **IRELAND.**

es: 100, Winchester House, London, E. C., Eng., Mine office:
County Cork, Ireland. R. J. Norton Dawson, chairman; A. E.
, secretary. Organized Aug. 26, 1904, with capitalization £10,000,
par; issued, £4,567. Property is an option to lease, at £20 yearly,
oyalty, a tract of about 900 acres, lying southwest of lands of the
n Copper Mines, Ltd. Property is undergoing exploration.

MINING CO. **UTAH.**

office: Bingham Canyon, Salt Lake Co., Utah. Lands lie be-
Bingham Consolidated and United States mines. Management
develop property by a 1,000′ tunnel. Idle.

A MINING & SMELTING CO., LTD. **MEXICO.**

Apartado 72, Monterey, N. L., Mex. Mine office: Viesca, Coa-
Employs circa 500 men. G. F. Meehan, president; Frank
, vice-president; Walter E. Parker, secretary and general man-

ager; F. W. Draper, superintendent. Operates the Santa Maria, Sultana and other mines, carrying ores of copper, lead, silver and gold, opened by a 700′ main shaft and a 1,000′ main tunnel. Has steam and electric power and a 250-ton smelter, blown in early in 1903, smelter and mines being connected by railroad. Smelter is said not to be operated regularly. Is conducted as a close corporation, company making no returns in response to questions. The general manager states that the company is increasing its cash surplus. Production, 1903, was 178,865 lbs. fine copper.

COAST LINE COPPER CO. MEXICO.

Office: La Calera, Altar, Sonora, Mex. John T. Cave, president; Judson A. Elliott, secretary; John Henderson, general manager. Organized, 1902, as successor of the Porvenir de Sonora company. Lands include a gold property at El Oro, 14 miles from Pozo, in the Ures district, and a copper property, formerly a profitable silver producer, in the Altar district. Gold mine has a plant with Huntington mills. At close of 1905, management was endeavoring to arrange for resumption of work at the gold property.

COAST RANGE COPPER CO.

Incorporated January 16, 1903, at Roseburg, Oregon, with capitalization $25,000, in 500 shares, par $50, by T. R. Sheridan, et al.

COBAR CHESNEY COPPER & GOLD MINING CO. AUSTRALIA.

Mine office: Cobar, Robinson Co., N. S. W., Australia. Employs about 100 men. J. Woolcock, manager. Was opened as a gold mine, the outcrop carrying no copper, but at depth of 155′ carbonate ores were found, and at 250′ depth chalcopyrite, coated with melaconite, in considerable quantities. Main shaft is about 600′ in depth, in ore carrying 2% to 8% copper and about 3 dwts. gold per ton, showing one 35′ ore body, averaging 3% copper for a length of 800′. Has steam power, 10-stamp mill and 25-ton concentrator, ore and concentrates being smelted at the Great Cobar works. Produces about 150 tons fine copper yearly. The concentration process, given a trial at the mine, has not proven a success, ores averaging about 3% only.

COBRE DE GRANDE MINING CO. MEXICO.

Office: Bisbee, Ariz. Lands, sundry claims, in Sonora, Mexico, slightly developed by tunnels, showing high grade auriferous copper ore.

CORBE GRANDE COPPER CO. MEXICO.

Absorbed by Cananea Consolidated Copper Co., S. A. Sundry shareholders are engaged in litigation, hoping to get something from the Greene Consolidated, but with poor prospects of success.

COBRE MINING CO. ARIZONA.

Same as Del Cobre Consolidated Mining Co.

COBRELOMA CONSOLIDATED COPPER CO. ARIZONA.

Office; 212 Henne Bldg., Los Angeles, Cal. Mine office: Middlemarch, Cochise Co., Ariz. Richard Gird, president; M. M. O'Gorman, vice-president; Wm. J. Gird, secretary and treasurer; preceding officers, Robert C. Davis and Edw. C. Kelley, directors. Organized under laws of California with capitalization $1,000,000, shares $50 par; issued, $500,000. Lands,

claims, in 9 groups, which have had more or less desultory development in the past, 9 miles west of Pearce, present terminus of the Arizono & Colorado railroad. Surface indications are promising, but development, which is to a limited depth only, has as yet shown no large ore bodies. Property is opened by the 165′ Ella shaft, showing 4% ore; the 105′ Emma shaft and the 120′ Emma tunnel, the 344′ Iron Age tunnel, crosscutting a 12′ vein, and the 386′ Carpena tunnel, planned to cut rich ore outcropping on the surface of Richmond Hill, and a 90′ tunnel on the Cobreloma claim, planned to penetrate Copper Glance Hill, which shows sulphide ore in a 70′ shaft. There also are several other shallow shafts. Ore occurs in a mineral zone carrying 6 distinct veins, which are substantially parallel, limestone and porphyry being the country rocks, with a garnet capping that is 200′ wide in places. Property has steam power and a telephone system, and is regarded as promising. It is planned to consolidate, 1906, with the Middlemarch Copper Co.

COMPAÑIA COBRIZA. **MEXICO.**

Letter returned unclaimed from former mine office, Tepezalá, Aguascalientes, Mexico.

MINA LA COBRIZA. **MEXICO.**

A mine, at Matehuala, San Luis Potosí, Mexico, operated by the National Metallurgical Co.

COMPAÑIA MINERA LA COBRIZA. **MEXICO.**

Mine office: San Dimas, Durango, Mexico.

COMPAÑIA MINERA COBRIZA y ANEXAS. **MEXICO.**

Mine office: Alamos, Sonora, Mexico. Manuel Salazar y Perron, manager. Ores carry gold, silver and copper. Mine is opened by shafts and tunnels.

MINA COBRIZAS. **BOLIVIA.**

Office and mine: Lipez, Bolivia. Is a considerable producer of native copper, making more or less silver as a by-product.

COCHISE CONSOLIDATED COPPER CO. **ARIZONA.**

Office: 1404 Arrott Bldg., Pittsburg, Pa. Mine office: Paradise, Cochise Co., Ariz. Employs about 50 men, mainly Mexicans. Henry F. Alexander, president and general manager; W. C. Hagan, vice-president; Howard H. Douglas, consulting engineer; Harry Holburn, superintendent; C. S. Hagan, mill superintendent. Capitalization $1,500,000, shares $1 par. Lands, 17 claims, including the Davis group of 13 claims, bought for $82,500, lying about 6 miles northeast of Paradise, where the company has platted a townsite called Pittsburg. The 150′ Ainsworth shaft is sunk at an angle of 60°. The Treasure shaft shows a 4′ vein giving average assay values of about $75 per ton in copper, gold and silver. The 180′ two-compartment Duplex shaft shows mixed sulphides, carrying high values in copper, gold and silver, and containing heavy percentages of zinc. Machinery includes Webber 5-h. p. and 150-h. p. gasoline engines, and a small electric light plant. The mine shipped some ore to smelters, late in 1904, and is building a concentrator, which should be in operation before

end of 1906. The mill is 62x100′, 45′ high, and is to have one
3 sets of rolls, 3 elevators, 2 jigs and 2 settling tanks. Water is
from two wells and is pumped into five 6,000-gallon tanks, mill
about 2,500 gallons daily. The property seems to be vigorously
and is considered promising.

COCHISE COPPER MINING CO.

Reorganized, August, 1905, as Cochise Development Co.

COCHISE DEVELOPMENT CO.

Office and mine: Bisbee, Cochise Co., Ariz. Employs 30 men
Shattuck, president; C. L. Jones, vice-president and general
Harry Duey, secretary; Joseph M. Muheim, treasurer; R. J. Ledwi
superintendent. Organized August 1, 1905, under laws of Arizo
capitalization $1,000,000, shares $10 par, as successor to the Cochise
Mining Co. Annual meeting, second Tuesday in January. L
claims, area 175 acres, abutting on the Holbrook mine of the Copp
Consolidated. Has a 300′ two-compartment shaft, with a drift
300′ level showing small bunches of sulphide ore. Shaft is being
to 3-compartment size, and is to be sunk to the porphyry-schist
and crosscuts driven thence to the presumed ore body. Machinery
a 10x30″ first-motion double-drum hoist, good for 1,200′, a 6-drill
straight-line air-compressor and a 100-h. p. Atlas boiler. Has
house, boiler-house, 20x40′ carpenter shop, 20x30 ′smithy and a co
Property is considered promising.

COCHISE EXPLORATION & DEVELOPMENT CO.

Office: Bisbee, Ariz. Mine office: Fronteras, Sonora, Mexico.
sundry claims at the southern end of the Ajo Mountains, about
west of Fronteras, showing ores assaying well in copper, lead, silver a

COCHISE MINING & MILLING CO.

Dead.

COCHISE PROSPECTING, MINING & DEVELOPMENT CO.

Succeeded, January 25, 1906, by Brooks Consolidated Copper

COCONINO COPPER CO.

Letters returned unclaimed from former office, Chicago, Ills., and
mine office, Ryan, Coconino Co., Ariz., via Kanab, Utah. Donald
president; L. P. Boyle, secretary; W. S. McCornick, treasurer; E. P. Jo
general manager. Organized 1901, under laws of New Jersey, with
ization $6,000,000, shares $10 par. Lands, 33 claims, area 660 acres,
acres miscellaneous lands, showing blanket veins carrying cas
ores, estimated to average 10% copper, which are stripped and worked
cast. Estimated amount of ore in sight is 500,000 tons, with 100,0
blocked out for stoping. Reduction plant, at Ryan, 7 miles from
receiving ore by wagons, has a 100-ton Neill leaching plant and a
smelter. Property is leased to Esmeralda Copper Precipitating Co.,

COLDWATER COPPER MINING CO.

Office: 232 West Cedar St., Kalamazoo, Mich. Mine office: Em
ment, Carbon Co., Wyo. Employs 30 men. Z. L. Baldwin, pres

E. S. Drury, vice-president; Edwin Gillis, secretary and treasurer; Burr Lobdell, general manager. Organized May 18, 1900, under laws of Wyoming, with capitalization $1,000,000, shares $1 par. Lands, 5 claims, area circa 50 acres, also 20 acres miscellaneous lands, in the Pearl district of Larimer county, Colorado. Property is known as the Wolverine mine. Country rocks are granite and diorite, with 3 fissure veins, of which one, of 20′ estimated width, shows oxide and carbonate ores, and native copper, with sulphides at a little depth, estimated to carry an average of 10% copper and 8 oz. silver per ton, opened by shafts of 80′ and 170′, bottom of principal shaft showing massive chalcocite and a little disseminated chalcopyrite, of high average grade. Developments are regarded as promising. Has steam power. Property has been leased, for a 3 to 5 year term, to the Wolverine Leasing & Mining Co., composed of Coldwater shareholders, and was producing 50 to 70 tons of ore daily, in spring of 1906.

SOCIEDAD COLECTIVA. **CHILE.**

Said to operate the Tiltil mine, department of Santiago, Chile. Title given probably is incomplete.

COLOMBIA GOLD & COPPER CO. **COLOMBIA.**

Thos. S. Moffat, president and Pooh-Bah. Capitalization, $125,000, shares $10 par. Lands are sundry undeveloped government concessions, in the Republic of Colombia.

COLONIAL COPPER CO. **NOVA SCOTIA & ONTARIO.**

Office: 716 Law Bldg., Baltimore, Md. Mine office: Cape D'Or, Cumberland Co., Nova Scotia. J. A. Hanway, president; W. J. Sneeringer, vice-president; Chas. J. Griffith, secretary; F. B. Speed, treasurer; Reginald W. Petre, general manager; S. M. Archibald, mine superintendent. Organized January 19, 1899, under laws of West Virginia, with capitalization $5,000,000. Bonds, $300,000 authorized, at 6%; issued, $116,000. Lands, circa 2,000 acres, well timbered, showing 6 contact veins, of which 3, undergoing development, are said to average 25′ width, and to carry 2.5% copper. Development is by a 500′ incline shaft and 2 vertical shafts. Equipment includes 3 large and 6 small hoists, 3 Rand air-compressors and sundry small mine buildings. Property has a 400-ton concentrator, with Blake crushers, rolls and 15 jigs, connected with the mine, 1½ miles distant, by a 36″ narrow-gauge railroad. Nearest railway is 30 miles, but property is located on the Bay of Fundy, and receives machinery and supplies by water. Company also owns the New Annan mine, carrying sulphide ore in lenses, and the Chandos mine, in Peterboro county, Ontario, latter showing a 4′ vein, assaying 8% copper, but idle for some years.

Company was in financial straits and a petition in bankruptcy was filed, 1905, but was dismissed later, through a practical reorganization, by shareholders, leading to a general change in the management.

COLONIAL COPPER CORPORATION, LTD. **AUSTRALIA.**

Offices: 615, Salisbury House, London, E. C., Eng. G. Hardie, chairman; C P. Oswald, secretary; J. Wills, mine manager. Organized March 29, 1899, with capitalization £125,000, shares £1 par; issued, £102,507.

Lands, 245 acres, freehold, 20 miles from Lithgow, Robinson county, New South Wales. Idle for some years.

COLORADO-BOHEMIA MINING & MILLING CO. — **COLORADO & OREGON.**

Office: 15, William St., New York. Albert Hawkins, president; G. B. Henzer, secretary and treasurer. Organized under laws of Colorado, with capitalization $1,250,000, shares $1 par. Lands, sundry gold and copper claims, in various districts of Oregon and Colorado.

COLORADO & CONNECTICUT GOLD MINING CO. — **COLORADO.**

Office: 35, Wall St., New York. Wm. Garlick, president; A. S. Garlick, secretary. Organized 1902, under laws of South Dakota, with capitalization $400,000, shares $5 par, non-assessable. Lands, 3 claims, area 21 acres, known as the Dolly Varden mine, in the Galena district of Hinsdale county, Colorado. Company is prospecting three 2′ fissure veins, giving assays of 9% to 19% copper, with good silver values, from chalcopyrite, tetrahedrite, and occasional argentite. Has a 50′ shaft and an 800′ tunnel. Company's prospectus quotes Edwin J. Hulbert as predicting (in 1879) that this property will equal the Calumet & Hecla as a dividend-payer. Presumably idle.

COLORADO CONSOLIDATED MINING CO. — **COLORADO.**

Mine office: Cochetopa, Saguache Co., Colo. Ores carry gold, silver and copper. Has steam power and a 10-stamp mill.

COLORADO COPPER CO.

A swindle, perpetrated by the notorious Wm. F. Wernse gang, of St. Louis.

COLORADO COPPER CO. — **NEW MEXICO.**

Office: care of Dr. H. W. Queen, Alva, Okla. Letter returned unclaimed from former mine office, Clayton, Union Co., N. M. J. W. Foster, president; T. S. Chambers, treasurer. Organized 1905. Lands, sundry claims, apparently undeveloped, in Cimarron Cañon, near Clayton.

COLORADO COPPER SYNDICATE, LTD.

Voluntarily wound up, April, 1901.

MINA COLORADO. — **MEXICO.**

Office: care of Independence Grove, owner, Guadalajara, Mexico. Lands, 10 pertenencias, area 25 acres, on the Rio Palmarejo, 12 miles west of Ameca, Jalisco, Mexico, showing a vein of about 6′ width, carrying auriferous and argentiferous copper and iron sulphides, opened by a 700′ tunnel.

MINA COLORADO. — **MEXICO.**

Mine office: care of Don Carlos Yanes, owner, San Xavier, Sonora, Mexico. Presumably idle.

COLORADO COPPER MINING CO. — **COLORADO.**

Claimed lands near Salida, Chaffee county, Colorado. Organized under laws of New Mexico, with capitalization $5,000,000. Apparently a mere stock-jobbing scheme.

COLORADO MINING & DEVELOPMENT CO. — **MONTANA.**

Title changed, 1904, to Wickes-Corbin Copper Mining Co.

COLORADO MINING & SMELTING CO. **MONTANA.**

Succeeded, 1905, by Trenton Mining & Development Co.

COLORADO RIVER GOLD & COPPER CO. **CALIFORNIA.**

Office: 503 Bradbury Blk., Los Angeles, Cal. Mine office: Mellen, San Bernardino Co., Cal. Employs 4 men. Geo. E. Bouton, president; W. O. Dresbach, vice-president; T. M. Drennan, secretary and treasurer; E. S. Gannon, assistant secretary; Henry Seltzer, general manager. Organized July 1, 1901, under laws of Arizona, with capitalization $1,500,000, shares $1 par; issued, $1,800,000. Lands, 10 claims, area 200 acres, also a 5-acre smelter-site, in the Monumental district, showing ore bodies occurring as fissure veins in limestone, granite and quartz-porphyry, of which one vein, of 3′ to 15′ width, is opened by shafts of 60′ and 75′, and by four tunnels of 30′ to 180′ length, giving about 1,200′ of underground openings, estimated to show 18,000 tons of ore, with 10,000 tons blocked out for stoping. Average assay values are 8% copper, 1 oz. silver and $15 gold per ton, from malachite, chalcopyrite and pyrrhotite. Company plans continuing development, and hopes to secure the building of a smelter, in the Empire Flats district, during 1906.

COLORADO SPRINGS COPPER MINING & TUNNEL CO. **COLORADO.**

Property sold, January, 1906, to Michigan & Colorado Mining & Milling Co.

COLOSSAL GOLD & COPPER CO. **UTAH.**

Organized, 1902, with capitalization $600,000, by F. F. Brown, Wallace W. Wait, et al, at Salt Lake City, Utah, to take over the C. M. C. group of claims, in Beaver county, Utah. No trace of operations.

COLUMBIA COPPER CO. **ARIZONA.**

Dead, with suspicions of foul play. Lands sold, under judgment, for $4,000.

COLUMBIA COPPER MINING CO. **ARIZONA.**

Merged in Consolidated King Development & Columbia Copper Co.

COLUMBIA COPPER MINING CO. **BRITISH COLUMBIA.**

Office: care of E. P. Wheeler, president, Conconully, Wash. Mine office, Princeton, Yale district, B. C. Lands, sundry claims, including the Gladstone, in the Similkameen district, showing a fissure vein of 5′ to 7′ width, in syenite and trap, carrying disseminated bornite, assaying 5 %to 6% copper, with fair gold and silver values.

COLUMBIA COPPER MINING CO. **UTAH.**

Property sold, 1903, to Ohio Copper Co.

COLUMBIA COPPER MINING CO. **WYOMING.**

Last heard of company was in December, 1902, when it was being sued, for sundry mining claims, by the Duchess Mining, Milling & Smelting Co.

COLUMBIA GOLD & COPPER CO.

Office: 27 Central St., Boston, Mass.

COLUMBIA GOLD & COPPER MINING & SMELTING CO.

Office: Rosalia, Wash. Moribund.

COLUMBIA MINING CO. **CALIFORNIA.**

Mine office: Needles, San Bernardino Co., Cal. H. R. Gunn, manager. Lands, sundry claims, 7 miles southwest of Needles, on which development work was in progress, at last accounts.

COLUMBIA MINING CO. **NEVADA.**

Office: Los Angeles, Cal. Mine office: Goodsprings, Lincoln Co., Nevada. Lands, 6 claims, said to show a 30′ vein, averaging 15% copper, which probably is an overestimate. The Extension vein, opened to a depth of 230′ and 3′ wide, shows ore chiefly carbonates and oxides, assaying highly in copper and carrying about $10 gold per ton. Mine is said to be prepared to produce 25 tons daily, and hopes to ship 75 tons daily, to the Goodsprings smelter, by August, 1906.

COLUMBIA RIVER GOLD MINING CO. **WASHINGTON.**

Mine office: Kettle Falls, Stevens Co., Wash. J. M. Fish, superintendent, at last accounts. Ores carry gold, silver and copper. Has steam power.

COLUMBUS BUTTE MINING CO. **MONTANA.**

Office: Columbus, Ohio. Mine office: 901 West Copper St., Butte, Silver Bow Co., Mont. M. J. Bergin, president; Edw. Higgins, manager. Lands, 5 claims, including the Jennie Dell mine and the Eveline, October, Twilight and Lamonta claims, latter held under a $33,000 bond and lease. Lands are west of the Lexington, lying west of Missoula Gulch. Principal operations, on the Eveline, are said to show an ore chute on the 150′ level, assaying 450 oz. silver and $50 gold per ton. The Jennie Dell has a 450′ shaft, showing, 1% copper, with gold and silver values, at a depth of 358′,on a 10′ vein, supposed to be a continuation of the Lexington vein. Management plans sinking a new 300′ three-compartment shaft, on the Lamonta, but was in bad shape financially, in May, 1906.

COLUMBUS CONSOLIDATED MINING CO. **UTAH.**

Office: 37 Commercial Blk., Salt Lake City, Utah. Mine office: Alta, Salt Lake Co., Utah. Employs circa 100 men. Anthony O. Jacobson, president and general manager; Clarence K. McCornick, vice-president; S. A. Whitney, secretary and treasurer; preceding officers, W. S. McCornick and Edward R. Hall, directors; McCornick & Co., registrars. Organized 1902, under laws of Utah, and capitalization increased, 1904, to $1,500,000, shares $5 par.

Lands, 17 claims, area 275 acres, on both sides of Little Cottonwood Cañon, mainly on Old Flagstaff Hill, showing 9 fissure and contact veins, 6 said to average 12′ width, and to carry estimated values up to 8% copper, 18% lead, 15% zinc, 60 oz. silver and $4.50 gold per ton. Principal ore bodies are fissures and contacts, in limestone and quartzite, with highly mineralized sections ranging 30′ to 100′ wide, for several hundred feet in length. Ores are carbonates on surface, and sulphides at depth. Shipping ore runs $10 to $60 per ton in value. Concentrating ores are reduced 4 or 5 into 1. and 327 tons of concentrates, made 1904, averaged $21.39 in value. Mine is opened by 4 shallow shafts and 3 tunnels,

wheel, working under a head of 494′, water being delivered through 20″ and 22″ steel pipe, developing 660 h. p., which is transformed ricity by two 300-kw. dynamos, and carried to the mine by a transmission line. Foundations are in for another wheel of the . There are four 25-h. p. hoists, good for 600′ each, a 10-drill ; air-compressor and a 5-drill Ingersoll-Sergeant air-compressor. e has a machine-shop and sawmill.

50-ton concentrator was built from the material secured out of two ton mills, these being the Tesora mill at Tintic, and the Weber- ill at Park City. Mill has a Gates gyratory crusher, 2 sets of Rogers 3-compartment jigs and 7 Wilfley tables. Concentrates ore shipped, , to Murray, for smelting.

first year's operations, 1905, gave returns of $281,626, with dis- ts of $251,478, including $50,000 indebtedness liquidated, and ,000 expended for buildings and equipment, leaving a net credit f $29,566. The management, which has been rather harshly crit- s "made good," and the property is one of great promise.

US COPPER CO. **ARIZONA.**

office: Clifton, Graham Co., Ariz. C. E. Stevens, superintendent. ping by tunnel.

US EXTENSION MINING CO. **UTAH.**

e: care of Antnony O. Jacobson, president and general manager, e City, Utah. Mine office: Alta, Salt Lake Co., Utah. Lands, acres, near the Columbus Consolidated, having an old 140′ tunnel. nned to develop by a new tunnel, of circa 6,500′ length.

-PARROT MINING & SMELTING CO. **MONTANA.**

e and mine: Butte, Silver Bow Co., Montana. Hon. Wm. A. resident; A. H. Wethey, vice-president and general manager; Bickford, secretary; Fred. Pratt, mill superintendent; David Mat- nelter superintendent. Organized November, 26, 1897, under laws ington, with capitalization $500,000, shares $50 par. Has paid , to close of 1905, of $1,760,000. Property is a concentrating ting plant, known as the Butte Reduction Works, on which abou t

with concentrates, and the roasted product carries 5% to 7% sulphur only. High-grade ore requiring no concentration is desulphurized by kiln-roasting, going thence to blast-furnaces. Smelter equipment includes two 150-ton blast-furnaces and three 80-ton reverberatory matting furnaces, 20x60' in size. Waste gases from the reverberatories are utilized for power purposes. The main dust-chamber, 60' to 80' wide, 30' high and 360' long has brick walls and sheet steel roof. The smelter has the largest concrete stack ever built, this being 352' 7" high, with a uniform diameter of 18' from top to bottom. Material required for this stack included 60 tons of steel, 1,500 barrels of Portland cement and 1,400 tons of sand. The foundation, 100' square, 3' deep, and weighing 12,800 tons, is made of molten slag, in solid blocks, interlaced with 70 tons of scrap iron and steel, leading from the base into the bottom of the stack. Above the foundation of slag is a solid block of concrete, 42' 6" square, 5' high at the sides and 8' 6" high in the center, with four layers of 1¼x1¼" "T" iron, also 500 bars of the same size "T" steel, radiating in a circle from the chimney opening. The stack was built at the rate of about 30' per week.

The converter plant, for bessemerizing the matte, was put in operation early in 1906. The building is of steel, with two stands and room for a third. Product of the plant, until the completion of the converter, was a matte carrying 55% copper, 75 oz. silver and $2 gold per ton, which was sent to the Nichols Chemical Works for electrolytic refining. The smelter is being modernized throughout, and the management is capable.

COMANCHE CONSOLIDATED COPPER CO. **NEW MEXICO.**

Office: care of Wm. D. Leehey, secretary, Seattle, Wash. Mine office: Fair View, Sierra Co., N. M. J. J. Haggerty, president; P. D. Johnson, vice-president; Marcus Murray, treasurer; preceding officers, Jas. B. Taylor, Mangus McEntosh and J. C. Arkard, directors. Organized 1906. Lands 14 claims, circa 10 miles from Fair View. Company plans doing about 5,000' of diamond drilling, before sinking shafts.

COMANCHE MINING & SMELTING CO. **NEW MEXICO.**

Office: 46 Loan & Trust Bldg., Milwaukee, Wis. Mine office: Silver City, Grant Co., N. M. S. S. Curry, president; Geo. J. Lonstorf, vice-president; Chas. J. Laughren, secretary and general manager; Carl Landsee, treasurer; Henry M. Edwards, superintendent; Victor Viderton, mine superintendent. Organized, 1902, under laws of Arizona, with capitalization $5,000,000, shares $1 par.

Lands, 38 claims, area 760 acres, including the Burro Mountain and Pinos Altos groups, both in the Burro Mountains, circa 13 miles from Silver City, also sundry orchard and ranch lands. The Burro Mountain group shows 3 lenses, carrying oxide, carbonate and silicate ores, giving average assays of 5% to 8% copper, with only nominal gold and silver values, with indications of sulphides at greater depth, development to date being on a limited scale.

The Pinos Altos mines were considerable producers for some years, under the ownership and management of the late Senator Hearst. The group shows 2 fissure veins, opened by 4 shafts of 400' to 700' depth. The Gillette is the

main working shaft. Ores are cuprite, malachite, azurite and chysocolla, in the upper workings, with sulphide ores below that give returns of 3% copper, up to 20% zinc, 15 oz. silver and $7 gold per ton. The Pinos Altos group has large bodies of low-grade ore developed. A 13-mile narrow-gauge railroad connecting the Pinos Altos mines with the smelter was completed early in 1906.

The old reduction plant, at Silver City, burned 1903, has been replaced by more modern works. The plant includes a concentrator with magnetic separators for zinc extraction, about 500 yards west of the rebuilt smelter, which has 5,000-ton ore-bins. The smelter has 3 furnaces. A 75-ton furnace was blown in January, and a second of the same size, March, 1906. The third, a 200-ton blast-furnace, is to be blown in upon completion of the narrow-gauge railway to Pinos Altos. The smelter also does a considerable custom business, product being blister copper averaging 98% copper, 150 oz. silver and 10 oz. gold per ton. In connection with the smelter are a briquetting plant, machine-shop, iron foundry, smithy, electric light plant, office building, and a number of dwellings for employes. The management is experienced and aggressive, and the property is considered promising.

COMMERCE GOLD & SILVER MINING CO. **ARIZONA.**

Letter returned unclaimed from former mine office, Duncan, Ariz.

COMMODORE COPPER MINING CO. **WYOMING.**

Letter returned unclaimed from former mine office, Encampment, Wyo.

COMMODORE MINES, LTD. **BRITISH COLUMBIA.**

Letter returned unclaimed from former office, Vancouver, B. C. Jas. R. Webster, president; H. W. Pegram, secretary. Organized June 20, 1902, under laws of British Columbia, with capitalization $750,000, shares $10 par. Lands were on Texada Island.

COMO-EUREKA MINE. **NEVADA.**

Owned by Federal Gold & Copper Co.

COMSTOCK MINE. **MONTANA.**

Mine office: Basin, Jefferson Co., Mont. Presumably idle.

COMSTOCK MINE. **UTAH.**

Mine office: Park City, Summit Co., Utah. Is said to have ore assaying 10% copper, 5 oz. silver and $10 gold per ton.

COMSTOCK MINE. **WYOMING.**

Office and mine: Hecla, Laramie Co., Wyo. Is owned by Martha Ferguson and leased by A. H. Lindsey, et al. Has a 150′ shaft and 300′ tunnel, showing small bunches of chalcocite.

COMSTOCK MINING CO. **WYOMING.**

Letter returned unclaimed from former office and mine, Encampment Carbon, Co., Wyo. Wm. Norell, president and general manager; C. B. Bergquist, secretary. Organized Oct. 1, 1900, under laws of Wyoming, with capitalization $1,000,000, shares $1 par. Lands, 5 claims, area 103 acres, also a 20-acre millsite, in the Battle Lake district, showing 4 fissure veins, of which two averaging 16′ width and giving assays of 15% copper, 20 oz. silver and $3.15 gold per ton, have been cut by a 250′ tunnel.

COMSTOCK & TASMAN LYELL, CONSOLIDATED. **TASMANIA**

Property is sundry partly prospected mining lands, on the western slope of Mt. Lyell, Montagu county, Tasmania.

COMSTOCK-TREADWELL GROUP. **WASHINGTON.**

Mine office: Orient, Ferry Co., Wash. Alexander Sharp, manager. Lands, sundry claims, 6 miles north of Orient, showing copper ore.

MINAS LAS CONCAVAS. **COSTA RICA**

An old copper property in Costa Rica, opened in the Eighteenth Century or earlier, reopened, circa 1900, and again idle.

COMPAÑIA MINERA CONCEPCIÓN DEL ORO. **MEXICO.**

Mine office: Concepciòn del Oro, Zacatecas, Mexico. Santiago Chamberlain, president; J. L. Kowalski, secretary and general manager; Santiago Chamberlain, Jr., superintendent; Juan Sanchez, mining captain. Organized 1902, with capitalization $30,000, shares $30 par. Lands, 32 pertenencias, area circa 80 acres, in the Mazapil district. A 4′ vein carries oxide ores averaging 30% copper, with gold and silver values. Shaft, 33 metres. Ore is shipped 336 miles, to smelters at San Luis Potosí. Has gasoline power and employed a considerable force, at last accounts.

GEWERKSCHAFT CONCORDIA. **GERMANY.**

Mine office: Herdorf, Rheinprovinz, Germany. Is a very small producer of copper ore.

CONCRETE GOLD MINING CO. **COLORADO.**

Office: 324 Cooper Bldg., Denver, Colo. Mine office: Central City, Gilpin Co., Colo. Saml. V. Newell, superintendent. Ores carry gold, silver, lead and copper. Has steam power.

CONDON MINE. **ARIZONA.**

Office and mine: care of T. C. Condon, owner, Oracle, Pinal Co., Ariz. Geo. E. Metz, superintendent. Has gasoline power. Presumably idle.

COMPAÑIA MINERA DE CONDORIACO. **CHILE.**

Mine office. La Serena, Coquimbo, Chile. Has steam power and employs about 75 men.

CONEJO-COLORADO MINING CO. **MEXICO.**

Mine office, Ocotlán, Oaxaca, Mex. F. B. Morse, manager. Mine is opened by shafts and tunnel, developing ores carrying gold, silver and copper. Has steam power, 5 stamps, 2 Huntington mills and a 30-ton cyanide plant.

CONFEDERATE MINING CO. **ARIZONA.**

Office: care of Col. Lee Crandall, president, Washington, D. C. Maj. D. W. Crabb, secretary and treasurer; Carl Crandall, manager. Organized Sept. 6, 1901, under laws of Arizona, with capitalization $1,000,000, shares $1 par. Property is the Candelaria group, on Reno Mountain, Maricopa county, Arizona, opened by shafts of 30′, 60′ and 64′, said to show a 12′ vein of sulphide ore, carrying a 4′ paystreak, giving assays of 20% copper.

CONGO MINE. **WYOMING.**

Mine office: Rudefeha, Carbon Co., Wyo. Lands, sundry claims, north of the Ferris-Haggarty mine, opened by an incline shaft and short tunnel, latter showing ores assaying well in copper, silver and gold, with a little nickel.

CONGOR GOLD & COPPER MINING CO. **UTAH.**

Office: 506 Auerbach Bldg., Salt Lake City, Utah. Mine office: Bingham Canyon, Salt Lake Co., Utah. C. G. Hall, manager. Lands adjoin the Dalton & Lark mine. Idle several years, until unwatered 1905. Is said to be under option to W. H. Tibbals, et al, for $150,000.

CONGRESS COPPER MINING CO. **COLORADO.**

Mine office: Red Mountain, Ouray Co., Colo. Geo. H. Foltz, manager. Has cupriferous gold and silver ores, opened by shafts and equipped with steam power, employing circa 30 men, at last accounts.

CONGRESS GOLD & COPPER MINING CO. **WASHINGTON.**

Letter returned unclaimed from former office, Spokane, Wash. Joseph Roslow, president; J. Goodrich, secretary. Lands, circa 80 acres, in the Keller district of Ferry county, Washington. Mine is opened by shafts and tunnels, on 2 veins giving good assay values in gold, silver and copper, with a little nickel. Idle.

E. P. CONNER CO. **CALIFORNIA.**

Office and mine: Redding, Shasta Co., Cal. Mining property idle.

CONQUEST CONSOLIDATED MINING CO. **WASHINGTON.**

Office: 426 Postal Telegraph Bldg., New York. Mine office: Newport, Stevens Co., Wash. John H. Shaw, president; J. W. Hays, secretary. Is a consolidation of the Conquest Gold & Copper Mining & Milling Co., and the American Eagle Mining & Milling Co. Lands, 12 claims, showing 3 veins of 4′ to 8′ width, opened by about 2,200′ of tunnels. Ore of good average grade has been uncovered in fair quantities, and considerable ore is blocked out for stoping. Has a good equipment, including steam power and air-compressors. Property considered promising. Idle.

CONQUEST GOLD & COPPER MINING & MILLING CO. **WASHINGTON.**

Reorganized, circa 1902, as Conquest Consolidated Mining Co.

CONRAD CONSOLIDATED MINE. **AUSTRALIA.**

Mine office: Howell, New South Wales, Australia. Ores are said to be argentiferous sulphides of copper, lead and tin—an unusual combination.

CONSERVATIVE MINING CO. **WASHINGTON.**

Office: Snohomish, Wash. Letter returned unclaimed from former mine office, Silverton, Snohomish Co., Wash. Frank M. Evans, president; Hugh Kennedy, secretary and manager. Organized under laws of Washington, with capitalization $200,000, shares 20 cents par. Lands, 10 claims, known as the St. Louis group, 3 miles from Silverton, said by company to show a 15′ vein—which is called by others a vein of 18″ to 36″ width—carrying argentiferous and auriferous chalcopyrite, assaying up to 20% copper. Idle.

CONSOLIDATED AFRICAN COPPER TRUST, LTD. **RHODESIA & MOZAMBIQUE.**

Offices: 8, Old Jewry, London, E. C., Eng. Mine office: Bulawayo, Rhodesia, South Africa. Dr. Hans Sauer, chairman; Consolidated Goldfields of South Africa, Ltd., secretary; Cyril E. Brackenbury, general manager. Organized Feb. 17, 1902, with capitalization £600,000, shares £1 par; issued, £484,000. Lands, 1,790 claims, including 135 claims in the Lomagunda

district, 900 in the Victoria district, 30 in the Kafue district, 20 in the Umtali district, 70 in the Tuli district, Mashonaland, 60 in Bechuanaland, 202 in Mozambique, and sundry miscellaneous holdings and rights, including coal lands, in which a half interest in two tracts is to be sold to the North Zambesi Coal Syndicate. Principal copper mining properties are the Alaska, Edmundian and Umkondo.

The Alaska mine, 90 miles northwest of Salisbury, shows the second largest ancient workings in Rhodesia, ore bodies having an estimated average width of 150′ and length of 1,700′, which figures probably are subject to revision. Copper ore has been found at a depth of 200′ to 800′ in numerous diamond drill borings, and company estimates that 150,000 tons of cupriferous schists, showing 3% copper, are exposed above the water level. The mine is idle, but the Salisbury-Lomagunda railroad is expected to be extended to within 13 miles of this property.

The Edmundian mine, in Mozambique, has 7 levels and has shipped 2,377 tons of 20% copper ore to England, for test smelting. The property is small, but apparently good.

The Umkondo mine, in the Victoria district, gives indications of making a large property. The tract has been been diamond drilled extensively, drill-cores giving average assays of above 9% copper. Several shafts have been sunk, showing 2 veins, with oxides above and sulphides below, and the company estimates that 43,470 long tons of ore, averaging 8.5% copper, are in sight. On Sept. 30, 1905, the company had 12,160′ of openings in its various mines. Management is good and property is considered promising.

CONSOLIDATED COPPER CO. **BRITISH COLUMBIA.**

Dead. Former offices were Minneapolis, Minn., and Ainsworth, B. C.

CONSOLIDATED COPPER CO. **OREGON.**

Office: Anderson, Ind. Mine office: Homestead, Baker Co., Ore. Organized Sept. 25, 1905, under laws of Oregon, with capitalization $2,500,000, shares $10 par, by Wm. Robertson, Wm. Garretson and A. E. Johnson, to develop copper claims on the Snake river, near Homestead.

CONSOLIDATED COPPER CO., LTD. **CORSICA & MEXICO.**

Offices: Dashwood House, London, E. C., Eng. F. Hawdon, chairman; S. J. Crouch, secretary; Thos. P. Rowe, manager. Organized June 10, 1899, as a reconstruction of the New Consolidated Mining Co., Ltd., with capitalization £100,000, shares 10s. par, 9s. 6d. paid in. Lands include La Bufa de Charcas and sundry adjoining claims, carrying copper, silver and lead ores, in the state of San Luis Potosí, Mexico, also the Lacone copper mines, in Corsica, idle for some years.

CONSOLIDATED COPPER CO. OF PARRY SOUND. **ONTARIO.**

Office: Duluth, Minn. Lands, sundry claims in the Parry Sound district of Ontario, including former holdings of the Hattie Belle Gold, Copper & Nickel Co. Is asserted to have 4,000,000 tons of ore in sight, claimed to carry net values of $10 to $15 per ton, which, of course, is not true. Idle.

CONSOLIDATED COPPER CO. OF VIRGINIA.

Office: 5 Beekman St., New York. Franklin Bien, president; Edw. T.

yne, vice-president; Jos. B. Bissell, treasurer; Nathan E. Clark, secretary. ganized October, 1902, under laws of South Dakota, with capitalization 00,000,000. Presumably abortive.

ONSOLIDATED COPPER MINING CO. **IDAHO.**

Succeeded, circa 1904, by Ladd Metals Co.

ONSOLIDATED COPPER MINING, MILLING & SMELTING CO. **COLORADO.**

Office: 417 Temple Court, Denver, Colo. Mine office: Eldora, Boulder Co., Colo. J. B. Johnson, president and general manager; C. M. Hunt, vice-president; E. W. Kelley, secretary; W. W. W. Jones, treasurer; H. T. Coates, superintendent. Organized Oct. 21, 1899, under laws of Colorado, with capitalization $3,000,000, shares $1 par. Annual meeting, second Tuesday in September. Lands, 18 claims, partly patented, area circa 150 acres, also sundry miscellaneous lands, giving total holdings of 350 acres, in the Grand Island district, showing 4 contact veins between granite and phonolite, of which one, under development, averages about 7′ width and is opened by 3 shafts, deepest 360′, and the 2,410′ Fourth of July tunnel, showing chalcocite, bornite and chalcopyrite returning average assays of 15% copper, 15% lead, 40 oz. silver and $20 gold per ton. Has steam power and 6-drill Leyner 2-stage air-compressor, with necessary mine buildings. Company plans continuing development.

CONSOLIDATED FLAGSTAFF MINING CO. **UTAH.**

Office: care of Philip D. Durant, secretary, Milwaukee, Wis. Mine office: Alta, Salt Lake Co., Utah. Thos. J. Pringle, president; John A. Kirby, vice-president and general manager; Kenneth W. Jacobs, treasurer; Wm. M. Wantland, assistant manager. Organized circa 1906, with capitalization $2,000,000, shares $25 par. Lands, 235 acres, including the Old Flagstaff mine, once a considerable producer, adjoining the Columbus, Consolidated. Management plans running a 2,400′ tunnel, and raising from the end to connect with the Old Flagstaff workings.

CONSOLIDATED GEM MINES CO. **COLORADO.**

Mine office: Idaho Springs, Clear Creek Co., Colo. W. S. Renshaw, manager. Ores carry gold, silver, lead and copper. Has steam power and a 10-stamp mill.

CONSOLIDATED GOLD & COPPER CO. **ARIZONA.**

Dead. A Douglas-Lacey swindle. See Amalgamated Gold & Copper Co.

CONSOLIDATED GOLD & COPPER CO. **MEXICO.**

Office: 813½ Chestnut St., St. Louis, Mo. Mine office: La Cananea, Sonora, Mex. H. M. Whitney, president and general manager. Organized under laws of District of Columbia, with capitalization $1,000,000. Lands, 1,729 acres, including the Chapultepec mine, area 988 acres, and the Corregidor mine, area 741 acres, adjoining properties lying about 6 miles southwest of Cananea, said to show a geological formation similar to that of the Capote mines of the Greene Consolidated.

CONSOLIDATED GOLD, COPPER & COAL CO. **COLORADO & WYOMING.**

Office: Encampment, Wyo. J. E. Hedding, president; J. W. Hedding, secretary. Lands include 2 copper claims, area 40 acres, near Pearl, Larimer

county, Colorado; 6 gold claims, known as El Rey gold mine, area 98 acres, and 3,595 acres of coal lands, circa 15 miles from Walden, Larimer county, Colorado. Latter tract is said to show a 65′ vein of coal, which could be developed by stripping. Coal lands are remote from transportation, but probably can be made valuable eventually. Idle.

CONSOLIDATED GOLD & COPPER MINING CO. **UTAH.**

Office: 25 Broad St., New York. Letter returned unclaimed from former mine office, La Sal, Grand Co., Utah. A. Graham Donnelly, president; Gid R. Propper, superintendent. Capitalization, $20,000,000. Claims also to have lands in Utah, Montana, Colorado and Oregon. Is grossly overcapitalized, idle, and presumably moribund.

CONSOLIDATED GOLD & COPPER MINING & MILLING CO. **WYOMING.**

Mine office: Encampment, Carbon Co., Wyo. Chas. W. Freeman, president; Andrew R. Olson, secretary. Lands, sundry claims, not generally considered to be well located.

CONSOLIDATED GREEN MOUNTAIN ST. LOUIS MINES, LTD. **BRITISH COLUMBIA.**

Office: care of Chas. D. Clark, treasurer, Peoria, Ills. Mine office: Rossland, Yale district, B. C. W. L. Lowry, president. Capitalization $3,000,000, shares $1 par. Has a 400′ shaft. Idle for several years.

CONSOLIDATED JEFFERSON GOLD & COPPER MINING CO. **UTAH.**

Office: 221 Atlas Blk., Salt Lake City, Utah. Nicholas Schmittroth, president; H. A. Nieman, vice-president and assistant manager; T. W. Butler, secretary; Frank Rumel, treasurer. Organized June, 1902, under laws of Utah, with capitalization $1,000,000, shares $1 par. Lands, sundry claims in the Big Cottonwood district, Salt Lake county, Utah.

CONSOLIDATED KING DEVELOPMENT & COLUMBIA COPPER MINING CO. **ARIZONA.**

Office and mine: Jerome, Yavapai Co., Ariz. Geo. W. Hull, president; H. E. Wilcox, secretary. Organized under laws of Arizona, with capitalization $6,000,000, shares $1 par. Lands, 34 claims, area 400 acres, in the Verde district, adjoining the United Verde on the south and east, showing several ore bodies carrying oxide, carbonate and sulphide ores, giving fair assay values in copper, gold and silver. Development is by a 400′ shaft and several tunnels, longest 1,750′. About $250,000 has been expended on the property, which has gasoline power. Management is said to plan installation of a reduction plant, during 1906.

CONSOLIDATED LA SAL MINING & SMELTING CO. **COLORADO.**

Office: North American Bldg., Philadelphia, Pa. Mine office: Cashin, Montrose Co., Colo. James N. McBride, general manager. Is a reorganization of the La Sal Copper Mining Co., which produced 270,000 oz. silver and 224 tons fine copper, valued at $212,286.69, after paying smelting charges, and from which dividends of $24,000 were paid. Lands, 10 claims, area 150 acres, opened by one shaft and 3 tunnels, having about 5,000′ of underground openings, on a 5′ vein claimed to average about 8% copper, and up to 134 oz. silver, with small gold values. Has steam and water power, leaching

plant and a small smelter. Property regarded as promising. Presumably idle.

CONSOLIDATED MERCUR GOLD MINES CO. **UTAH.**

Office: P. O. Box C, Salt Lake City, Utah. Mine office: Mercur, Tooele Co., Utah. John Dern, president; Wm. M. Thompson, secretary; Geo. H. Dern, treasurer and general manager. This is one of the leading gold mines of the United States, and is a producer of the precious metals only at present, but has at its mills tailings carrying thousands of tons of copper, which eventually should be recovered, to a considerable extent.

CONSOLIDATED MINES & DEVELOPMENT CO. **ARIZONA.**

Mine office: Globe, Gila Co., Ariz. Organized 1905, with capitalization $500,000, shares $1 par. Lands, 8 claims, at the head of Arkansas Gulch, 7 miles west of Globe, from which diamond drill cores have shown 6% ore, apparently from stringers in the ledge. A 45′ shaft is said to be bottomed in solid sulphide ore.

CONSOLIDATED MINING & SMELTING CO. **NEW MEXICO.**

Mine office: Cerillos, Santa Fé Co., N. M. R. B. Thomas, manager; J. L. Wells, superintendent. Ores carry gold, silver, lead, copper and zinc. Company works the Tom Paine, Albany and other mines. Property is extensively developed, well equipped with gasoline and electric power, and employs 100 men or upwards. Has a 120-ton lead smelter, and secures a trifling amount of copper as a by-product.

CONSOLIDATED MINING & SMELTING CO. **UTAH.**

Dead. Formerly had lands at Brigham, Box Elder Co., Utah.

CONSOLIDATED MINING & SMELTING CO. OF CANADA, LTD. **BRITISH COLUMBIA.**

Operating office: Trail, Yale district, B. C. W. D. Matthews, president; Geo. Sumner, vice-president; W. H. Aldridge, managing director; preceding officers, E. B. Osler, H. S. Osler, W. L. Matthews and Chas. R. Hosmer, directors. Organized, 1905, as Canadian Consolidated Mines, Ltd., and name changed, circa February, 1906, to present title, by supplementary letters patent. Capitalization $5,500,000, shares $100 par; issued, $4,698,888. First quarterly dividend, of 2.5%, was paid April, 1906. Is a securities' holding corporation, controlling, through stock ownership, the Centre Star Consolidated Mining Co., War Eagle Consolidated Mining & Development Co., Ltd., St. Eugene Consolidated Mining Co., Ltd., Canadian Smelting Works and Rossland Power Co., all of which are separately described, under their respective titles.

CONSTELLATION GOLD MINES CO. **OREGON.**

Mine office: Sumpter, Baker Co., Ore. J. Higgins, superintendent, at last accounts. Ores carry gold, silver, lead and copper.

CONSOLIDATED NICKEL, TIN & COPPER MINES, LTD.

Offices: 50, Fenchurch St., London, E. C., Eng. W. T. Strong, secretary. Organized March 21, 1903, under laws of Guernsey, with capitalization £60,000, shares £1 par; issued, £58,480.

CONSOLIDATED STANLEY MINING & MILLING CO. **COLORADO.**

Office: Jacksonville, Ills. Mine office: Idaho Springs, Clear Creek Co.,

Colo. John M. Jackson, superintendent. Ores carry gold, silver, lead and copper. Has steam and water power, and a 10-stamp mill, employing circa 40 men, at last accounts.

CONSOLIDATED UNITED VERDE JUNIOR MINING CORPORATION. **ARIZONA & COLORADO.**

Office: Old Orchard, Me. Letter returned unclaimed from former mine office, Jerome, Yavapai Co., Ariz. Daniel L. Dean, president; F. A. Sidelinger, secretary and treasurer. Capitalization $2,000,000, shares $1 par. Has lands in Gilpin county, Colorado and is supposed to have, or to have had, lands in Yavapai county, Arizona, showing oxide and carbonate ores that have given assays of 34% to 53% copper and $6 to $29 gold per ton.

CONSTELLATION MINE. **ARIZONA.**

Mine office: care of Wm. F. Roberts, owner, Briggs, Yavapai Co., Ariz. Has auriferous copper ores. Presumably idle.

CONSTANTINE COPPER MINING CO. **WYOMING.**

Office: 76 East Third St., Winona, Minn. Letter returned unclaimed from former mine office, Encampment, Carbon, Co., Wyo. W. H. Elmer, president, John Tonsley, secretary; Earle R. Clemens, treasurer. Organized November, 1903, under laws of Wyoming, with capitalization $250,000, shares $1 par; in 150,000 shares preferred and 100,000 shares common stock. Lands, 3 claims, area 60 acres, opened by a 22′ shaft and a 60′ tunnel.

CONSTELLATION CONSOLIDATED COPPER MINES. **CALIFORNIA.**

Mine office: Campo Seco, Calaveras Co., Cal. E. J. Berger, superintendent, at last accounts. Has steam power.

CONSTITUTION MINE. **BRITISH COLUMBIA.**

Mine office: New Alberni, Vancouver Island, B. C. Lands, ¼ mile from tidewater, on Coos Creek, about 3 miles from New Alberni, show gold-copper ore, in a 140′ tunnel. Presumably idle.

MINA CONSUELO. **MEXICO.**

Office: care of Dr. A. F. Gavilan, owner, Durango, Mex. Letter returned unclaimed from former mine office, Yerbaniz, Durango, Mex. Ores carry copper, silver, gold and lead.

CONSUMNES MINE. **CALIFORNIA.**

Owned by Rio Vista Gold & Copper Mining Co.

CONTACT GROUP. **ARIZONA.**

Office: care of A. A. Patterson, owner, Globe, Gila Co., Ariz. A group of 7 claims, near the Bobtail mine, circa 15 miles from Globe.

CONTENTION MINING CO. **COLORADO.**

Mine office: Silverton, San Juan Co., Colo. G. E. Collins, manager, at last accounts. Ores carry gold, silver and copper values Has steam and water power.

CONTINENTAL ALTA MINES. **UTAH.**

Owned by the Continental Mines & Smelting Corporation.

CONTINENTAL CONSOLIDATED MINING CO.

Office: care of Ben Blanchard, manager, Mayer, Ariz. Lands, sundry claims, presumably in Yuma county, California, but possibly in San Bernar-

dino county, California, near the proposed line of the new Arizona & California railroad.

CONTINENTAL COPPER CO. **MEXICO.**

Office: care of City Brewery, San Antonio, Texas. Mine office: Panuco de Monclova, Coahuila, Mex. Otto Koehler, president: A. L. Tuttle, general superintendent; Arthur H. Luck, mine superintendent. Organized circa 1905, with capitalization $150,000. Ownership and management are practically the same as that of the Jimulco Mining Co.

Property bought, circa 1905, of the Panuco Copper Co., Ltd., includes extensive mines at Panuco and Romero Rubio, Coahuila, Mexico. The Panuco is an old property, opened circa A. D. 1700, and worked at intervals since, the aggregate production having been very considerable. The Panuco Copper Co., Ltd., previous owner, was organized 1898, and in seven short years suffered strange mutations of fortune, which went from bad to worse. The ores, as worked, are said to give average returns of about 6% copper. The failure of the Panuco company affords no criterion by which to judge the value of the property, as that corporation was mismanaged, to put the case mildly.

Present owners, who are energetic and wealthy, are going about the work of rejuvenation in a business-like manner. Operations being costly, because of rail connections, it has been decided to build a 75-kilometer narrow-gauge railway, connecting Panuco with one of the Mexican trunk lines, and rails and 3 locomotives, one of the cog-wheel type, have been bought for the line.

A concession has been secured from the state legislature of Coahuila for a smelter at Monclova, and a 300-ton plant is to be constructed. Part of the smelting plant of the Descubridora Copper Co., has been bought for this purpose, and will be removed to Monclova from Descubridora, Durango, Mexico. Under the present energetic management, the Panuco, which, in 1902, made only 665 tons fine copper, may become an important producer.

CONTINENTAL COPPER CO. **SOUTH DAKOTA.**

Office: Lima, Ohio. Mine office: Hill City, Pennington Co., S. D. Samuel A. Baxter, president; H. A. Holdridge, vice-president; W. J. Booth, secretary; Wm. F. Neuman, treasurer. Organized 1904, under laws of South Dakota, with capitalization $3,000,000, shares $1 par. Is a holding company only, property consisting of a two-thirds stock interest in the Dakota-Calumet Co., which is idle. Had some sort of an interest in the Maloney-Blue Lead Copper Mining Co., but apparently has lost it.

CONTINENTAL COPPER CO. **WYOMING.**

Office: Colorado Springs, Colo. John M. Harran, president; J. W. Wallwork, secretary. Lands, sundry claims in vicinity of Battle, Carbon county, Wyoming. Presumably idle.

CONTINENTAL COPPER MINING CO. **WYOMING.**

Mine office: Battle, Carbon Co., Wyo. J. T. Brown, superintendent, at last accounts. Property is in the Cow Creek district, and is said to show a large body of low-grade ore. Has a 6x8″ hoist and a 25-h. p. boiler. Idle at last accounts.

CONTINENTAL COPPER SYNDICATE, LTD.

Offices: 70, Cornhill, London, E. C., Eng. Organized September 28, 1905, with capitalization £500; shares, 1s. par. Floated the Mitterberg Copper Co., Ltd., receiving in payment cash and £50,000 in shares of latter-named corporation.

CONTINENTAL GOLD MINING CO. OREGON

Mine office: Nugget, Douglas Co., Ore. W. B. Stewart, president and general manager. Ore is an auriferous iron-copper sulphide, with values principally in gold. Is said to be building a 50-ton concentrator.

CONTINENTAL MINES & SMELTING CORPORATION. UTAH.

Offices: 90 Wall St., New York, and 409 Dooly Bldg., Salt Lake City, Utah. Mine office: Alta, Salt Lake Co., Utah. Employs circa 100 men. Henry M. Crowther, president and general manager; Horace E. Parker, vice-president; G. C. Van Alstyne, secretary and treasurer; R. S. Smith, superintendent. Organized July, 1903, under laws of New York, with capitalization $1,500,000, shares $10 par. Empire State Trust Co., New York, registrar. Lands, 30 claims, area 460 acres, about half patented, also a 20-acre millsite, in the Little Cottonwood district. Country rocks are limestone, porphyry, granite, and quartzite, said to show about 20 contact veins, between limestone and porphyry, of 1′ to 40′ width, giving assays of 2% to 35% copper, 10% to 48% lead, 7.5% zinc, 15 oz. to 120 oz. silver and 60c. to $5 gold per ton, from malachite, azurite and oxide ores of copper, galena, sphalerite, etc., estimated to carry average values of about $25 per ton. Has 5 shafts, deepest 200′, and 9 tunnels, of 300′ to 2,000′, with total underground openings of circa 18,000′, estimated by company to show 742,000 tons of ore, with 242,000 tons blocked out for stoping.

Present company holds lands formerly held by the Lavinia, Grizzly Consolidated, Darlington, and Regular mining companies, which are said to have produced upwards of $1,000,000 in ore. Mines were first opened, circa 1864, and were idle, 1892 to 1899.

A 5-mile Riblet aerial tramway was nearly completed, at end of 1905. This is a costly, but essential improvement, as the road was very bad and frequently impeded by snow-slides, while freight rates were $1.75 per ton on outgoing ore, and $5 per ton on ingoing fuel and supplies. The property also has a 100-ton concentrator, and production was begun 1905. At close of year mill was treating about 100 tons of ore daily, putting four into ore and turning out about 25 tons of concentrates, said to be carrying about 40% lead and 15 oz. silver per ton. Some of the company's ores carry tungsten and molybdenum. Power is furnished by water from Little Cottonwood Creek, actuating a direct-connected Pelton wheel.

Company paid to end of 1905, eleven 2% dividends on issued treasury stock, amounting to $24,000, and these payments cannot be justified on sound financial principles. The property, however, seems to be valuable, and the management apparently is endeavoring honestly, and with a considerable degree of success, to put the property on a sound productive basis.

CONTINENTAL MINING CO. **WYOMING.**

Office: 20 Metropolitan Opera House Bldg., St. Paul, Minn. Letter returned unclaimed from former mine office, Encampment, Carbon Co., Wyo. A. L. Cox, president; A. Messer, vice-president; Ker D. Dunlop, secretary and treasurer. Organized November, 1898, under laws of Wyoming, with capitalization $800,000, shares $1 par. Lands, 7 claims, 6 patented, area 125 acres, also a 20-acre millsite, in the Battle Creek district, carrying several fissure veins, of which two, opened by tunnels of 105′ and 820′, show a vein of 15′ estimated average width, giving average assays of 13.5% copper, 4.3 oz. silver and $5 gold per ton. Mine is served by the Southern Wyoming tramway of the Penn-Wyoming Copper Co., the third power station being located on the Continental property. Company hopes to continue development during 1906.

CONTINENTAL SMELTING & REFINING CO. **COLORADO.**

Office: Albany Hotel, Denver, Colorado. Mine office: Ironton, Ouray county, Colorado. E. S. Andrews, president; G. J. Butcher, vice-president; W. J. Sawyer, secretary and general manager; E. W. Averill, treasurer; preceding officers, W. W. Tuxbury, H. A. Thompson and Dr. Jas. A. Morrow, directors; Joseph Irving, smelter superintendent; G. H. Richardson, engineer. Organized 1903, under laws of Colorado, with capitalization $500,000, shares $1 par; issued, $300,000. Lands, 14 claims, area 125 acres, in the Red Mountain district, showing sundry fissure and contact veins, of which one, under development, averages 1′ to 7′ width, showing melaconite, chalcopyrite, enargite, sphalerite and galena, giving assays of 1% to 30% copper, from nothing to 72 oz. lead, from nothing to 4% zinc, from 2 oz. to 1,500 oz. silver and from $1 to $20 gold per ton. Development is by shafts of 70′ and 92′ and by tunnels of 60′, 75′, 500′, 500′, 700′ and 1,000′, with a total of 5,985′ of underground openings, estimated to show 75,000 tons of oxidized ores and 150,000 tons of sulphide ores. Mine has a 100-h. p. steam plant and electric motors. Buildings include necessary shops, office, bunkhouses, and a smelter having two 100-ton water-jacket blast-furnaces, planned to turn out matte averaging about 30% copper, 150 oz. to 400 oz. silver and 1 oz. to 5 oz. gold per ton. Property is served by the Red Mountain & Silverton railroad. Company plans to continue development work, and hopes to blow in the new smelter about July 1, 1906. Management seems businesslike, and property is regarded as promising.

COONEY HILL GOLD & COPPER MINING & MILLING CO. **WYOMING.**

Office: Cheyenne, Wyo. John Brown, secretary. Lands supposedly are in the Encampment district of Carbon county, Wyoming.

COONEY MINE. **NEW MEXICO.**

Owned by Mogollon Gold & Copper Co.

CO-OPERATIVE MINING CO. **WASHINGTON.**

Letter returned unclaimed from former mine office, Berlin, Wash.

CO-OPERATIVE MINING & MILLING CO. **WYOMING.**

Letter returned unclaimed from former mine office, Encampment,

Lands include groups of mines at Copiapó and Puquios, also a half-interest in the Republicana mine and a large estate near Copiapó. This was one of the first, if not the very first, of the British copper mining companies to operate in Chile.

The Dulcinea mine, at Puquios, was opened 1854, and long has been a considerable producer. The Fletcher shaft is 2,760′ in depth, and is to be deepened. The Weir shaft is 1,800′. Ores are oxides and carbonates, to a depth of about 600′, succeeded by sulphides. Ores ranged from 5% to 25% copper tenor, with an average of 14.8%, for the fiscal year 1905. Upper levels have a vein up to 25′ in width. The lower workings are very hot, and in 1905 the property suffered from a serious mine fire, that shook down soot and sulphur, which ignited from the heat. Ore reserves to the 450-fathom level are poor, but the showing below the 480-fathom level is better, the south drift on this level showing a 3′ vein of 15% ore. Production of the Dulcinea decreased in the fiscal year 1905, owing both to damage from the fire and to decreased values and lessened ore reserves. The Dulcinea has an aerial tram.

The Descubridora mine, in the Checo district, opened 1825, was the company's original mine. Main shaft is about 2,700′ deep, and the property was the principal producer of the company until recently, but in 1905 raised only 658 long tons of ore, compared with 10,160 metric tons in 1903.

The Ojancos group, taking its name from the district of its location, includes the Carmen Alto, San Francisco and Antonia. As a whole the Ojancos properties have proven disappointing, but are by no means devoid of promise of future betterment. The Carmen Alto has a 400′ main shaft, which is being deepened, and a pump of 60,000 gallons daily capacity is being installed to handle the water, which has proven somewhat troublesome latterly. The mine was looking fairly well at the close of 1905.

The San Francisco has a 350′ main shaft, which is being deepened. Ore taken from this mine, during the fiscal year 1905, gave average returns of 16% copper.

The Antonia mine is as yet in the development stage. The Republicana was idle during 1905, and was showing poorly when closed down.

The company has a concentrating mill, but this has not given satisfactory work, the tailings losses being unduly heavy. The works include an extensive lixiviation plant, at Puquios. Production of the company was 3,131,520 lbs. fine copper in 1904, and 2,515,520 lbs. in 1905.

COPPER AGE MINING & SMELTING CO. **WYOMING.**

Mine office: Battle, Carbon Co., Wyo. Lands, 12 claims, circa 2 miles north of Battle, opened by the 300′ Copper Blossom shaft, sunk on a quartz vein showing little ore at and near surface, but which is said to give a good showing of concentrating ore below 200′ depth.

COPPER BAR MINING CO. **NEW MEXICO.**

Office: 135 Adams St., Chicago, Ills. Mine office: Organ, Donna Ana Co. N. M. E. Percy Warner, president; Henry Stephens, secretary and treasurer; C. N Anthony, superintendent. Organized 1900, with capitaliza-

tion $1,000,000, shares $1 par. Lands, 8 unpatented claims, area 150 acres, in the Organ Mountains, showing two lenses, said to be contacts between limestone and porphyry, carrying chrysocolla and carbonate ores, said to average 14%, copper, with small gold and silver values, opened by shafts of 112′, 132′ and 177′. Idle.

COPPER BAR MINING CO. **WYOMING.**

Office: care of W. J. Crane, president and general manager, Arlington, Neb. Lands include the company's own holdings on Cow Creek, also the Charter Oak property of 14 claims, 5 patented, lying 8 miles north of Encampment, held under bond and lease, 1905, from the Charter Oak Copper Mines, Ltd. Operations are confined to the Charter Oak group, which has a 488′ shaft, with 750′ of underground openings. Former development was misdirected, shaft having been sunk at right angles to the vein. The Charter Oak property is said to show sulphide ores averaging 12% copper, several ounces silver and $6 gold per ton, and to have upwards of 300,000 tons of low-grade ore blocked out, which seems excessive. Vein carries oxides and carbonates above and sulphides below, and has a schistose gangue. Property has steam power and management plans erecting a concentrator and smelter, when rail connections are secured.

COPPER BASIN GOLD & COPPER MINING CO. **ARIZONA.**

Office and mine: 42 Bank of Arizona Bldg., Prescott, Yavapai Co., Ariz., Alfred B. Noxon, president and secretary. W. W. Munds, superintendent. Capitalization $1,000,000, shares $1 par. Lands, 17 claims. Has a 140′ shaft, and has secured good assay values from auriferous and argentiferous copper ores. Has steam power. Apparently moribund.

COPPER BASIN MINING CO.

Has lands on the Colorado river, near the Bill Williams Fork river, presumably in Yuma county, Arizona, but possibly in San Bernardino county, California, and, late in 1905, planned combining with other companies in the vicinity to secure the erection of a custom smelter, on Empire Flats.

COPPER BASIN MINING CO. **COLORADO.**

Office: care of B. B. Harlan, president, Chicago, Ills. mine office: Placerville, San Miguel Co., Colo. Milton Evans, superintendent. Lands, 15 claims, opened by shaft. A carload of ore shipped to smelter returned 14% copper and $2.50 gold per ton. Presumably idle.

COPPER BELL MILL & MINING CO. **MONTANA.**

Dead. Property at Clinton, Missoula county, Montana, was sold by the sheriff, January 10, 1905.

COPPER BELL MINE. **WASHINGTON.**

Owned by Bunker Hill-Sullivan Mining & Smelting Co.

COPPER BELLE MINING CO. **ARIZONA.**

Office: 43 Wooster St., New York. Mine office: Gleeson, Cochise Co., Arizona. Peter Quinn, president; Elie J. Moneuse, treasurer; preceding officers, Henry J. Mayer, Frank H. Hereford and George E. Crawford, directors; J. G. Hately, superintendent. Organized 1904, under laws of Ari-

includes a 60-h. p. steam plant, with 20-h. p. and 40-h. p.
od for 1,000′ depth. Buildings are a 20x30′ machine-shop
ouses.

rty is one of great possibilities, because of the vast and
stible extent of its ore body. The proposition is a big one
as been learned by the management, which, in the spring of
nducting negotiations for the enlisting of additional capital
operty needs—and the showing warrants the expenditure—
ble investment in tunneling and shaft-sinking, by which more
ened, followed by exhaustive mill-tests for concentration, and
to determine average values. A few dozen assays afford an
equate basis for passing upon the average values of a property
at size. As much money will be needed to properly test the
te as would develop a small mine, but, should the test show aver-
of even half the copper tenor shown by the assays, the prop-
sufficient time and capital, could be made one of the really
er mines of the world. The management is good, including a
experienced mining men, but the proposition is so much greater,
aspect, than first thought, that the raising of considerable further
perative, if the property is to be given a thorough test.

BUTTE MINING CO. SOUTH DAKOTA.

office: Custer, Custer Co., South Dakota. Harry Frances,
ndent, at last accounts. Presumably idle.

BUTTES CONSOLIDATED MINING & ELTING CO. CALIFORNIA.

ice: care of Burden Gaylord, president, Los Angeles, Cal. Mine
Bagdad, San Bernardino Co., Cal. J. B. Harvey, vice-president.
ization $1,000,000, shares $10 par. Lands, 31 claims, in two
, 10 claims being near Ibis and balance near Bagdad. The Ibis
shows a quartz vein in granite, carrying auriferous and argent-
s chalcopyrite, which is highly silicious, requiring heavy fluxing
500′ two-compartment shaft, with about 3,000′ of openings, on vein
″ to 4′. About 2,000′ of openings have been made on the Bagdad
s, without finding payable ore. Management is considered hone
prospects are considered poor.

PER CAÑON MINING CO. NEW MEXI

Mine office: Abiquiu, Rio Arriba Co., New Mexico. J. E. Ir
erintendent. Lands, 100 acres of undeveloped mineral claims.

PPER CANYON MINE. BRITISH COLU

Lands, sundry claims near the foot of Mt. Sicker, British Colu
ened by two tunnels, cutting a 4′ vein, showing good ore. Idle.

)PPER CANYON MINING CO. ARI

Mine office: Mayer, Yavapai Co., Arizona. S. T. Allen, pre
. T. Carr, vice-president; E. A. Girvin, secretary; C. A. Westenber
er; preceding officers, J. F. Littlefield, C. H. Haight and Wilbur
ell, directors. Organized under laws of Arizona, circa 1905, wi

fair mine buildings, and has shipped some good ore to the Crofton
Was developing, with a small force, late in 1905.

COPPER CLIFF MINES OF MONTANA, LTD. MO

Offices: 8, Broad Street Ave., London, E. C., Eng. Mine office
via Elliston, Powell Co., Mont. S. E. Illingsworth, chairman; R. S.
worth, mine manager; A. Hebden, secretary. Organized Sept. 11,
with capitalization £200,000, shares £1 par, in £65,000 "A" pr
shares and £135,000 common shares, preference shares taking all
up to par value of stock, after which preferred becomes common sto
sued, £30,282. Lands, 140 acres, known as the Copper Cliff group,
of the Copper Cliff Mining Co. Mine has a 200′ shaft and tunnels o
500′ and 800′, showing contact veins of fair width, carrying oxide, car
and sulphide ores, which are said to give average assay values of 10
per and $10 gold per ton. Company is said to plan operations on
siderable scale.

COPPER CLIFF MINING CO. ARI

Dead. Property sold, 1902, to Catalina Mining Co.

COPPER CLIFF MINING CO. MONT

Succeeded, 1903, by Copper Cliff Mines of Montana, Ltd.

COPPER CLIFF MINING CO. SOUTH DAK

Office: 79 Dearborn St., Chicago, Ills. Mine office: Rochford,
nington Co., S. D. B. F. Brazee, president; Chas. A. Fohrman, vice-pre
and general manager: E. W. Eldridge, secretary. Organized 1899, u
laws of South Dakota, with capitalization $1,000,000, shares $1
Property, carrying copper ore and graphite, is opened by a 350′ tunnel,
ing an 8′ vein of low-grade copper ore. No copper mining has been
for several years, but company is mining graphite and making paint th
from, in Chicago.

COPPER COBRE MINING CO. ARIZO

Dead. Succeeded by Bradshaw Mountain C. M. & S. Co., also dead.

COPPER COMPANY OF BRITISH COLUMBIA, LTD. BRITISH COLUM

Offices: 11, Grocers' Hall Ct., London, E. C., Eng. Moribund.

COPPER CONCENTRATING CO. MICHIG

Office and works: Houghton, Houghton Co., Mich. Frank How
president; Thos. G. Mays, secretary and superintendent; T. H. Noble, tr
urer; G. H. Elmore, consulting engineer. Organized July, 1905, with a
talization $75,000. Has a 10-year contract with the Quincy Mining C
for reworking the tailings from the Quincy mill, at Mason, on Torch La
Mill is 72x122′, with a wing of 38x58′ containing the power plant, and sta
upon sands wasted from the Quincy mill. Sands for reworking are ta
from the lake by a 16x28′ scow, carrying a 12x24′ pumphouse, with sm
ugal sucker pump, connected by a 10″ spiral pipe with the
ing swing joints and being carried on bents. At the m
charged into a launder connecting with the boots of
elevators, in t
two

Arizona, with capitalization $3,000,000, shares $1 par. Lands, 32 claims, patented, area 320 acres, showing five 7′ fissure veins, carrying oxide ores, with claimed values of 10% copper, 2 oz. silver and $80 gold per ton, which is much too high. Has shafts of 202′ and 238′, and a 464′ tunnel. Company's advertising is entirely too lurid. The goods promised therein cannot be delivered.

COPPER BULLION MINING CO. **ARIZONA.**

Office: 224 Byrne Bldg., Los Angeles, Cal. Mine office: Pearce, Cochise Co., Ariz. Ezra T. Stimson, president; Percy H. Clark, secretary; Chas. M. Renaud, superintendent. Organized 1900, under laws of Arizona, with capitalization $1,000,000, shares $1 par. Lands, 30 claims, in the Turquoise district, showing 3 veins, claimed to average 14′ in width, assaying 9% copper, 7 oz. silver and $4 gold per ton, from carbonate and sulphide ores, which, of course, is too high. Has 4 shafts, deepest 210′, and tunnels of 80′ and 900′. Idle for some time.

COPPER BUTTE MINES. **ARIZONA.**

Office: 1007 New York Life Bldg., Minneapolis, Minn. Mine office: Phœnix, Maricopa Co., Ariz. Augustus C. Sheldon, president and general manager; Geo. H. Abeel, vice-president; Benj. C. Sheldon, secretary; Henry W. Knoche, treasurer; Allan G. Wilson, superintendent. Employs 6 men.

Organized July 21, 1900, under laws of Arizona, (under title Arizona Copper Mountain Mining Co., changed June, 1904, to present name), with capitalization $6,000,000, shares $10 par; issued, $4,500,000. Report of company, as of date January 1, 1906, gave assets of $70,000, with $3,000 cash due company, and $3,500 cash on hand, without liabilities.

Lands, 34 unpatented claims, area 690 acres, in the Walnut Grove district of Pinal county, Arizona, also a 5-acre millsite. Lands reach to the Gila river, which furnishes an unfailing water supply, and mine is served by the Phœnix & Eastern railway, only 1½ miles from the property. Country rocks are granite and limestone, intruded by an immense cupriferous breccia, ranging 1,300′ to 3,000′ in width, which has been traced about 7,000′. The breccia carries oxide and carbonate ores at surface, and for some little depth, succeeded by sulphides, which are shown in the lowest workings of the mine. The average assay of 39 samples gave 7.39% copper, with circa $2 gold per ton, but the average of copper in actual production would be much lower, in all likelihood.

The first mining was done, 1879–1881, for silver, but was not a success, and the property remained idle until taken over, 1900, by present company. Development is by about twenty 15′ pits, six shallow shafts of 30′ to 60′ depth, and two shafts of 175′ and 465′ respectively, also by four tunnels of less than 100′ length, and two of 275′ and 300′ respectively, longest tunnel giving a depth of about 600′ below the crest of the outcrop. The mine has about 2,000′ of openings, estimated by management to show about 5,000,000 tons of ore, this apparently excessive figure being rendered more plausible by the vast width of the ore body.

Equipment includes a 60-h. p. steam plant, with 20-h. p. and hoists, latter good for 1,000′ depth. Buildings are a 20x30′ mach and two bunkhouses.

The property is one of great possibilities, because of the almost inexhaustible extent of its ore body. The proposition is a however, as has been learned by the management, which, in the s 1906, was conducting negotiations for the enlisting of additional What the property needs—and the showing warrants the expen is a considerable investment in tunneling and shaft-sinking, by whi ground is opened, followed by exhaustive mill-tests for concentrati smelter-tests to determine average values. A few dozen assays afi entirely inadequate basis for passing upon the average values of a pr of such great size. As much money will be needed to properly te Copper Butte as would develop a small mine, but, should the test show age values of even half the copper tenor shown by the assays, the erty, given sufficient time and capital, could be made one of the great copper mines of the world. The management is good, includ number of experienced mining men, but the proposition is so much gr in every aspect, than first thought, that the raising of considerable fu sums is imperative, if the property is to be given a thorough test.

COPPER BUTTE MINING CO. SOUTH DAK

Mine office: Custer, Custer Co., South Dakota. Harry Fra superintendent, at last accounts. Presumably idle.

COPPER BUTTES CONSOLIDATED MINING & SMELTING CO. CALIFOR

Office: care of Burden Gaylord, president, Los Angeles, Cal. M office: Bagdad, San Bernardino Co., Cal. J. B. Harvey, vice-presid Capitalization $1,000,000, shares $10 par. Lands, 31 claims, in t groups, 10 claims being near Ibis and balance near Bagdad. The I group shows a quartz vein in granite, carrying auriferous and arge iferous chalcopyrite, which is highly silicious, requiring heavy fluxi Has a 500′ two-compartment shaft, with about 3,000′ of openings, on vei of 18″ to 4′. About 2,000′ of openings have been made on the Bagd claims, without finding payable ore. Management is considered hones but prospects are considered poor.

COPPER CAÑON MINING CO. NEW MEXICO

Mine office: Abiquiu, Rio Arriba Co., New Mexico. J. E. Irvin superintendent. Lands, 100 acres of undeveloped mineral claims. Idle.

COPPER CANYON MINE. BRITISH COLUMBIA

Lands, sundry claims near the foot of Mt. Sicker, British Columbia, opened by two tunnels, cutting a 4′ vein, showing good ore. Idle.

COPPER CANYON MINING CO. ARIZONA.

Mine office: Mayer, Yavapai Co., Arizona. S. T. Allen, president; L. T. Carr, vice-president; E. A. Girvin, secretary; C. A. Westenberg, treasurer; preceding officers, J. F. Littlefield, C. H. Haight and Wilbur Treadwell, directors. Organized under laws of Arizona, circa 1905, with capi-

talization $15,000,000, shares $1 par. Lands are 5 claims and a millsite, in the Black Canyon district, formerly held by the Black Canyon Copper Co., Ltd., which went out of business without paying its debts. Claims are considered promising, but capitalization is excessive, and company is not regarded with favor.

COPPER CAVE MINING CO. **WYOMING.**

Mine office: care of J. F. Crawford, Saratoga, Carbon Co., Wyo. Idle.

COPPER CENTER GROUP. **MEXICO.**

A group of claims near Moctezuma, Sonora, Mexico, on which some development work was done, by Dew R. Oliver, of San Francisco, California.

COPPER CENTURY GROUP. **ARIZONA.**

Mine office: Washington, Santa Cruz Co., Ariz. Geo. A. Lonsberry, superintendent. Ores carry copper, zinc, lead and silver. Has gasoline power. Presumably idle.

COPPER CHIEF MINING CO. **ARIZONA.**

Mine office: Jerome, Yavapai Co., Ariz. Arthur Hendy, superintendent. Lands, sundry claims near the Iron King mine of the Equator Mining & Smelting Co., circa 5 miles south of Jerome, on which the final payment of $65,000 was made February, 1906. Mine shows a large body of auriferous and argentiferous copper ore, and is claimed to have upwards of $3,000,000 worth of ore blocked out, which probably is an overestimate, although the property is generally regarded as one of considerable promise.

COPPER CHIEF MINING CO. **NEW MEXICO.**

Dead. Succeeded, 1903, by Sater Copper Co.

COPPER CHIEF MINING CO. **WASHINGTON.**

Office: Everett, Wash. Lands, 4 claims, between Galena and Mineral City, in the Silver Creek camp, Snohomish county, Washington, opened by a 600′ tunnel, showing an 8′ vein with a 2′ paystreak.

COPPER CHIEF MINING CO., LTD. **MONTANA.**

Office: 604 The Rookery, Spokane, Wash. Mine office: Dillon, Beaverhead Co., Mont. Employs 14 men. H. A. Fosselman, president; J. S. Graves, vice-president; F. M. Longshore, secretary and general manager; F. M. Dudley, treasurer; S. C. Bishop, mine superintendent. Organized June, 1901, under laws of Washington, with capitalization $375,000, shares 25 cents par. Lands, 7 claims, area 130 acres, in the Silver Star district of Madison county, Montana. Country rocks are granite and limestone, showing 5 contact veins, on all of which a little opening has been done, by 9 pits and shafts of 10′ to 112′ depth. Main vein, estimated by company to average 10′ width, shows carbonates at surface, with chalcocite and chalcopyrite at a little depth, giving average assays of 10% copper, 2 oz. to 5 oz. silver and $1.60 to $31 gold per ton. Mine was opened 1898, closed 1903, reopened April 1, 1906. Has a 40-h. p. hoist, good for 1,000′, and necessary mine buildings. Company plans sinking main shaft to depth of 1,000′.

COPPER CITY MINE. **ALASKA.**

Office: Coppermount, Prince of Wales Island, Alaska. Lands, sundry claims on the beach, at Cordova Bay, 6 miles south of Coppermount. Has

of same title, which, in turn, succeeded the Derby Syndicate, Ltd., with capitalization £15,000, shares 5s. par. Lands, 1,050 acres, freehold, near Northampton, Western Australia.

COPPER EXPLORERS, LTD. **AUSTRALIA.**

Offices: Winchester House, London, E. C., Eng. A. E. Barton, chairman: L. Malleson, secretary. Organized January 1, 1900, with capitalization £40,000, shares £1 par, to acquire the North Cobar mine, in New South Wales. Idle.

COPPER FALLS MINE. **MICHIGAN.**

Absorbed, 1898, by Arnold Mining Co. Fully described in Vol. I.

COPPERFIELD MINES. **VERMONT.**

Office: 820 Pennsylvania Ave., Pittsburg, Pa. Mine office: Copperfield, Orange Co., Vt. Geo. Westinghouse, owner. Property includes the old Ely and Copperfield mines, having a strong ore body carrying low-grade disseminated chalcopyrite. Has a 3,700′ main shaft, sunk at an angle of 23°, giving a vertical depth equal to circa 1,500′, and has a 1,000′ tunnel, leading from the 300′ level to mill. Reduction plant includes a combined mill and smelter, connected with the mine by a gravity tram. Smelter has two water-jacket blast-furnaces, one reverberatory furnace and one converter stand, making blister copper of 98% to 99% tenor, when operated. Property was worked on a considerable scale, previous to circa 1860, and was reopened by present owner in 1900, but has been idle for several years.

COPPERFIELD MINING CO. **UTAH.**

Letters returned unclaimed from former office, Bingham Canyon, Utah.

COPPER FIELDS OF NAMAQUALAND, LTD. **CAPE COLONY.**

Offices: 10, St. Helen's Place, London, E. C., Eng. Lieut.-Col. W. W. Cragg, chairman; N. A. Eustace, secretary. Organized Sept. 31, 1897, with capitalization £100,000, shares £1 par; issued, £78,432. Lands, 354 acres, in Little Namaqualand, Cape Colony, South Africa. Idle.

COPPER GIANT GOLD & COPPER MINING CO. **WYOMING.**

Letter returned unclaimed from former mine office, Encampment. Carbon Co., Wyo. D. Frank Powell, president; P. H. Kennedy, secretary, Presumably moribund.

COPPER GIANT MINING CO. **ARIZONA.**

Office: care of O. Z. Kane, general manager, Tucson, Ariz. Mine office: Silver Bell, Pima Co., Ariz. Lands, 50 claims, in several different groups, lying south of the Imperial mine and to the eastward of the Silver Hill Mountains, opened by about 500′ of shafts and tunnels, with a 100′ shaft on the Copper Giant claim. Property shows a contact vein, with bold outcrops, between limestone and quartzite. Ore is chalcopyrite, with occasional chalcocite, and ores from the Copper Giant shaft are claimed to average 15% copper, 20 oz. to 40 oz. silver and $1 to $7 gold per ton.

COPPER GIANT MINING CO.

Office: care of L. B. Cornell, secretary, Spokane, Wash. Wm. H. Ludden, president. Organized 1897, under laws of Washington, with capitalization $1,000,000, shares $1 par. Lands, said to be 3 claims, with a fair show

ing of ore. Company has no money and doesn't know where to get any.

COPPER GLANCE MINING CO. **ARIZONA.**

Office and mine: Bisbee, Cochise Co., Ariz. S. W. Clawson, president and treasurer; A. S. Barker, secretary; C. L. Beckwith, general manager. Organized March, 1901, under laws of Arizona, with capitalization $2,500,000, shares $1 par. Annual meeting, March 9. Lands, 24 patented claims, area 480 acres, in the Warren district, about 7 miles southeast of Bisbee. Has shafts of 50′, 100′, 140′ and 560′, with tunnels of 75′ and 150′. Idle since circa 1904. Fully described in Vol IV.

COPPER GLANCE MINING CO. **NEW MEXICO.**

Mine office: Taos, Taos Co., N. M. Idle for several years.

COPPER GLANCE MINING & MILLING CO. **COLORADO & WYOMING.**

Office: Sherwood Bldg., Elgin, Ills. Mine office: Encampment, Carbon Co., Wyo. H. N. Anderson, president; N. C. Westerfield, vice-president; C. L. Wetzel, secretary and treasurer; Jas. N. McBride, general manager. Organized under laws of Wyoming, with capitalization $2,000,000. Property is known as the Giroutte group. Company also had an option on property in the La Sal district of Montrose county, Colorado, but apparently has lost same. Wyoming property idle since April, 1905, and company ended the year with an indebtedness of about $32,000, including $7,500 interest, and manifests no disposition to pay its debts, the energies of the management apparently having been exhausted in peddling stock.

COPPER GLOBE GROUP. **UTAH.**

Office: care of Dr. Walter R. Pike, owner, St. George, Utah. Lands, sundry claims, in the southwestern part of Emery county, Utah, showing a large body of low-grade ore, slightly developed by tunnel, 1899-1901.

COPPER GLOBE MINING CO. **UTAH.**

Dead. Lands, in Utah, sold November, 1902.

COPPER-GOLD MINING CO. **WASHINGTON.**

Mine office: Bossburg, Stevens Co., Wash. S. G. Wilson, superintendent, at last accounts. Developments show argentiferous copper ores. Idle.

COPPER-GOLD MINING & MILLING CO. **WYOMING.**

Letter returned unclaimed from former mine office, Hecla, Wyo.

COPPER GORGE DEVELOPING CO. **NEW MEXICO.**

Office: 82 Wisconsin St., Milwaukee, Wis. Mine office: Santa Rita, Grant Co., N. M. Lands, 12 claims. Company is asserted, in the press, to have put in a big machinery plant and concentrator, and to plan shipping concentrates to the Comanche smelter, at Silver City. Company apparently was promoted by C. T. McElroy, of questionable reputation, and is not regarded with favor.

COPPER HILL MINE. **ALABAMA.**

An idle property, near Stone Hill, Cleburne county, Alabama. Was known first as the Woods mine. Opened 1870, closed 1879. Had a smelter and worked as many as 500 men. Closed, owing to exhaustion of high-grade ores. Vein is 24′ wide, mineralized near walls to extent of 3% to 7% copper. Value of production secured was about $1,300,000.

COPPER HILL MINE. ARI

Owned by Arizona Commercial Copper Co.

COPPER HILL MINE. CALIFO

Office and mine: care of W. F. Detert, owner, Jackson, Amador Cal. Mine, on the Consumnes river, was opened circa 1861, and w about 20 years, with a considerable production. Vein formation, q porphyry, is 500′ to 600′ wide, with heavy gossan capping. Ore is chal rite, associated with iron pyrites.

COPPER HILL MINING CO. ARIZ

Correct title is Arizona Copper Hill Mining Co.

COPPER HILL MINING CO. NEW MEX

Dead. Lands, sold, November, 1903, to A. B. Renehan, for $7,

COPPER HILL MINING & MILLING CO. WASHING

Office: 504 Empire Bldg., Spokane, Wash. F. J. Heller, presi G. O. Nettleton, secretary. Organized 1899, with capitalization $75, shares 5c par. Lands, 4 claims, area 80 acres, in the Newport dis of Stevens county, Washington, with rail and water transportation ea accessible. Has a 230′ shaft and a 260′ tunnel, showing an 18′ vein co ing chalcopyrite, disseminated in pyrrhotite. Idle at last accounts.

COPPER HILL MINING & SMELTING CO. ARIZO

Office: care of Stephen Burger, president, Salem, Mass. Letter retur unclaimed from former mine office, Jerome, Yavapai Co., Ariz. John Jackson, superintendent. Organized 1905, under laws of Arizona. La sundry claims, known as the Kyle-Hopkins group, having 250′ of openi showing native copper and high-grade ore.

COPPER INDEPENDENT CONSOLIDATED MINING CO. WASHINGT

Office: 61 Court St., Boston, Mass. Mine office: Silverton, Snohomi Co., Wash. M. V. Little, president; E. P. Crooker, secretary; Arthur W Hawks, general manager. Capitalization $3,000,000, shares $1 par. Bon $62,000 outstanding. Lands, 2 groups of claims, also several mill Has 5 tunnels, longest 1,200′, with several thousand feet of undergro workings, on a fissure vein in granite. Plant includes a concentra 52x133′, of wood, equipped with crushers, rolls and tables, said to be of tons daily capacity. A turbine develops 550 horse power from the Sk aguamish river. Company began selling stock and paying 6% dividends si taneously, and came to grief, as predicted by the Copper Handbook. Pro erty possibly of value, if handled by an honest and capable manageme

COPPER JACK MINING CO. UTA

Office and mine: Eureka, Juab Co., Utah. J. C. Jensen, president J. T. Williams, vice-president; Geo. A. Udall, secretary; D. D. Hank treasurer; Geo. Hanson, general manager. Organized July 31, 1905, und laws of Utah, with capitalization $75,000, shares 10 cents par. Lands, claims, area 480 acres, in the Erickson district, Tooele county, Uta opened by a 22′ shaft, showing ore assaying 13% copper. Idle.

COPPER KEY MINE. WASHINGTO

Mine office: Republic, Ferry Co., Wash. E. J. Delbridge, manag

Lands adjoin the Oversight group, on the north. The upper tunnel is in ferruginous copper ore, and 90 cars shipped to smelter gave average returns of $12 per ton. The 400′ lower tunnel is in limestone, and is said to show a 40′ vein of shipping ore. A third tunnel is planned.

COPPER KING OF ARIZONA. **ARIZONA.**

Office: 116 Nassau St., New York. Letter returned unclaimed from former mine office, Pearce, Cochise Co., Ariz. Elisha Boitel, president; Thos. F. Gaynor, secretary and treasurer. Organized, 1903, under laws of West Virginia, with capitalization $5,000,000, shares $1 par, as successor of the Copper King of Arizona Mining Co., organized 1895, which peddled stock assiduously for many years, under management, first of the late B. C. Davis, and later, under control of Gaynor. Operations were begun at Bisbee, transferred thence to Solomon Springs, thence to Barrett and thence to Pearce, all in Cochise county, Arizona. Original property, the old Copper King mine, at Bisbee, was lost to company, 1903, through neglect, but having become prospectively valuable, suit was brought for recovery, but was lost, October, 1905. A $250,000 issue of 7% bonds is supposed to have been authorized, circa 1905. Management of preceding company was flagrantly bad for many years, and present corporation shows but slight improvement. Is in debt for labor, and local standing of management is nil.

COPPER KING OF ARIZONA MINING CO. **ARIZONA.**

Reorganized, 1903, under title Copper King of Arizona.

COPPER KING CONSOLIDATED MINING CO. **COLORADO.**

Incorporated, April, 1903, by Milo A. Smith, et al, with capitalization $300,000, to operate in Jefferson and Park counties, Colorado. Idle.

COPPER KING, LTD. **CALIFORNIA.**

Mine office: Letcher, Fresno Co., Cal. Geo. W. Ade, receiver; C. D. Leavitt, Jr., superintendent. Was an English corporation, and is said to have been wound up in 1903, but the estate is still in the process of adjustment, and the property is in operation. Lands, 90 acres, circa 27 miles from Fresno, opened by 2 air shafts and a 250′ main working shaft, with six levels opened and about one-half mile of drifts. Shaft is to be sunk 200′. Ore body is a schistose vein of about 100′ width, with a 2′ to 20′ paystreak carrying oxide and carbonate ores above, and sulphides below, ores averaging about 7% copper. Ore formerly was hauled 17 miles, by a traction engine, to the smelter at Seal Bluff Landing, but is now hauled by wagon. The reduction plant included a concentrator and smelter, latter having two 50-ton McDougall roasting furnaces for pyritic smelting, and a 100-ton reverberatory furnace burning crude petroleum. It is probable that the reduction plant has been sold, as ore is now sent to Tacoma for smelting. The property is doing very well, under the management of Mr. Ade, and, although ending 1905 with a net indebtedness of $500,000, a legacy from the old management, which squandered about £250,000, ended the year with $78,000 in the bank and $35,000 worth of ore in transit and at the smelter. Production is at the rate of 100 tons of ore daily.

COPPER KING MINE. **ARIZONA.**

Office and mine: care of Peter Johnson, owner, Bisbee, Cochise Co., Ariz. This is the original property held by the Copper King of Arizona, but was abandoned several years ago, and relocated, 1903, by present owner. Has a 625′ shaft, in porphyry, which has cut a number of small stringers of copper ore. Property, which lies between the Denn-Arizona and Cochise Development tracts, was generally regarded as worthless, until circa 1904, but developments on the Junction property indicate the possibility of considerable ore bodies underlying the porphyry, near its junction with limestone, in the Warren district. Material on dump, taken from shaft, is altered and slightly mineralized porphyry, carrying considerable iron pyrites.

COPPER KING MINE. **ARIZONA.**

Mine office: Johnson, Cochise Co., Ariz. S. A. D. Upton, owner. A prospect only. Idle at last accounts.

COPPER KING MINE. **BRITISH COLUMBIA.**

Lands, six claims, near the Queen Victoria property, at Beasley, 7 miles west of Nelson, Kootenay district, British Columbia, showing several exposures of sulphide ore. Has a gravel overburden, rich in float ore. Idle for some years.

COPPER KING MINE. **BRITISH COLUMBIA.**

Mine office: Kamloops, Yale district, B. C. Lands, sundry claims, 16 miles west of Kamloops, showing ore giving assays of 5% to 20% copper, 1 oz. to 6 oz. silver and $10 to $20 gold per ton. Shipped 500 tons to the Crofton smelter, May, 1904.

COPPER KING MINE. **CALIFORNIA.**

Office and mine: care of W. A. Sanger, Big Pine, Inyo Co., Cal. Has an outcrop of 100′ width, with a 60′ shaft, showing malachite. Idle some years.

COPPER KING MINE. **COLORADO.**

A property at Turrett, Chaffee Co., Colo., held by Calumet Copper Co.

COPPER KING MINE. **COLORADO.**

Office and mine: care of John Westenrider, owner, Florence, Fremont Co., Colo.

COPPER KING MINE. **COLORADO.**

Office and mine: care of Duress & Dowd, lessees, Gilpin, Gilpin Co., Colo. Property is said to show good copper ore.

COPPER KING MINE. **COLORADO.**

Mine office: Twin Lakes, Lake Co., Colo. Lands, 11 claims, on Middle Mountain, circa 13 miles from Twin Lakes, owned by James Harrison, et al. Formation is micaceous granite, with porphyry dykes, showing a 20′ fissure vein, with a 12″ paystreak on the hanging-wall carrying good assay values in copper, silver and gold. Is slightly developed, by tunnel.

COPPER KING MINE. **IDAHO.**

Mine office: Landore, Washington Co., Idaho. Is said to have a 15′ vein showing a 3′ paystreak of bornite, and, at last accounts, 1905, was preparing to begin shipments to the Landore smelter.

COPPER KING MINE. **MONTANA.**

One claim, 2 miles southeast of Parrot, Madison county, Montana, giving ores assaying up to 12.5% copper, 0.85 oz. silver and $2.80 gold per ton Idle.

COPPER KING MINE. **OREGON.**

Mine office: Comer, Grant Co., Oregon.

COPPER KING MINE. **SOUTH DAKOTA.**

Letter returned unclaimed from former mine office, Terry, S. D.

COPPER KING MINE. **TASMANIA.**

Mine office: Burnie, Tasmania. Property, on the northwest coast, has shipped 42 tons of 14% ore to Newcastle. Employs 9 men.

COPPER KING MINE. **WASHINGTON.**

Lands, sundry claims, in Ferry county, Washington. Ores include argentiferous galena, and chalcopyrite that is both auriferous and argentiferous. Development is by 2 tunnels.

COPPER KING MINE. **WASHINGTON.**

At Chewelah, Wash. Owned by Chewelah Copper King Mining Co.

COPPER KING MINE. **WYOMING.**

Mine office: Jelm, Albany Co., Wyo. Said to have been sold, 1902, to Messrs. Martin & Lambert, of Chicago, for $30,000.

COPPER KING MINE. **WYOMING.**

Letter returned unclaimed from former mine office, Tie Siding, Wyo.

COPPER KING MINE. **YUKON.**

Mine office: Whitehorse, Yukon, Canada. Has a 175′ shaft, showing bornite below depth of 20′. Has shipped 400 tons of high-grade ore to smelters at Everett, Wash., and Ladysmith, B. C. Property is decidedly promising, but cannot be made a producer until given better shipping facilities, or a local smelter, present freight rates being outrageously high.

COPPER KING MINING CO. **ARIZONA.**

Mine office: Tucson, Pima Co., Ariz. Lands, sundry claims, in the Tucson Mountains.

COPPER KING MINING CO. **BRITISH COLUMBIA.**

Mine office: Cameron Lake, Nanaimo district, B. C. Has a 100′ tunnel, showing copper ore. Idle for several years.

COPPER KING MINING CO. **COLORADO.**

Office: Cheyenne, Wyo. Mine office: Boulder, Boulder Co., Colo.

COPPER KING MINING CO. **COLORADO.**

Succeeded, circa 1904, by Pearl Copper Mining & Smelting Co.

COPPER KING MINING CO. **IDAHO.**

Office and mine: Shoup, Lemhi Co., Idaho. Earl Gilbreath, manager. Is a limited partnership. Lands, 11 claims, area 220 acres, also 260 acres miscellaneous lands, on Beaver Creek, in the Mackinaw district, showing numerous fissure veins in quartzite, of which three, with average width of 10′ to 12′, are opened by 2 shallow shafts and 7 tunnels, of which 3 are 300′ each in length, with a total of about one half-mile of openings, showing cuprite and malachite giving average assays of 7% copper, up to 30% lead,

1 oz. to 30 oz. silver and $1 to $3 gold per ton, ore averaging about $43 per ton in total values. Is working, with a small force.

COPPER KING MINING CO. **MONTANA.**

Letter returned unclaimed from former mine office, Missoula, Mont.

COPPER KING MINING CO. **OREGON.**

Letter returned unclaimed from former office, Pendleton, Ore. Incorporated, August, 1902, with capitalization $1,500,000.

COPPER KING MINING CO. **UTAH.**

Lands, supposedly 3 claims, in the Big Cottonwood district, Utah.

COPPER KING MINING CO. **WASHINGTON.**

Mine office: Sumas, Whatcom Co., Wash. Presumably idle.

COPPER KING MINING CO. **WYOMING.**

Letter returned unclaimed from former mine office, Rawlins, Wyo.

COPPER KING MINING & MILLING CO., LTD. **IDAHO.**

Office: Kellogg, Idaho. Mine office: Iron Springs, Idaho Co., Idaho. Employs 10 men. P. P. Webber, president; Peter Mason, vice-president; Chas. W. Simmons, secretary; Ed. Hearing, treasurer; Chas. McKinnis, general manager; Jos. Rogers, superintendent. Organized March 2, 1902, under laws of Idaho, with capitalization $1,250,000, shares $1 par. Lands, 7 claims, area 140 acres, also a 10-acre millsite and 80 acres timber lands, with total landed holdings of 230 acres, in the Rapid River division of the Seven Devils district. Property shows two fissure veins, in phonolite, of which one, of 8′ to 10′ width, is opened by 7 pits and shafts, deepest 50′, and by tunnels of 55′, 200′ and 300′, showing argentiferous and auriferous bornite, and medium grade chalcopyrite, giving assays up to 45% copper, up to 445 oz. silver and up to $45 gold per ton. Management plans continuing mining development, building roads and ore-bins, and beginning stoping, during 1906.

COPPER KING MINING & MILLING CO. **WASHINGTON.**

Office and mine: Vancouver, Clark Co., Wash. Organized January, 1904, with capitalization $1,000,000, shares $1 par. Presumably idle.

COPPER KING MINING & MILLING CO. **WASHINGTON.**

Organized, 1898, under laws of Washington, with Geo. R. Trask, president, and Sam Hanauer, secretary. No trace of company's lands or present office found, after protracted investigation.

COPPER KING MINING & SMELTING CO. **IDAHO.**

Office and mine: Mullan, Shoshone Co., Idaho. Employs 4 men. E. B. Crawford, president; H. W. Ingalls, secretary and general manager. Wm. Commerilh, treasurer. Organized August 28, 1905, under laws of Idaho, with capitalization $1,500,000, shares $1 par. Company reports $10,430 cash on hand, April 27, 1906. Lands, 6 claims, in the Hunter and Leland districts, carrying a contact vein, between quartzite and limestone, said to range 10′ to 40′ in width, opened by a 40′ shaft and an 1,800′ tunnel, showing sulphide ore assaying 5% copper, 30% to 40% lead and 16 oz. silver per ton. Company plans sinking the shaft 100′, and drifting therefrom.

COPPER KING MINING SYNDICATE. **WASHINGTON.**

Office: Tacoma, Wash. R. E. McFarlane, president; E. Areith, secretary and treasurer; D. E. Guiley, superintendent. Capitalization, $10,000,000.

Lands, 64 claims, in Pierce county, Washington. Company has acquired the old Eastlick mine, opened by a 130′ crosscut tunnel, with a small amount of drifting, which has produced some good ore. District is said to be rich, but not easily accessible. Idle.

COPPER KINGS MINING CO. **UTAH.**

Was promoted by H. C. Baker, of Ogden, Utah. Dead. Formerly held lands near Brigham, Box Elder county, Utah. Was succeeded by Consolidated Mining & Smelting Co., also dead.

COPPER KNOB MINING CO. **NORTH CAROLINA.**

Succeeded, circa 1902, by Blue Ridge Copper Mining Co.

COPPER-LEAD SMELTING CO. **WASHINGTON.**

Office: care of H. A. Noble, Seattle, Wash. Wm. Selover, manager. Organized 1905. Plans building a copper and lead smelter and refinery, to cost about $1,000,000, on Puget Sound, near and tributary to Seattle. Plans call for a smelter to have about 1,000 tons daily copper capacity and about 500 tons daily lead capacity, with refinery to include a 50-ton copper plant, 50-ton lead plant and 50-ton gold and silver refinery.

It is planned to begin construction about June, 1906, and to complete the works within one year. Plant is planned to operate on coast and Alaskan ores, and, if built, will be the largest reduction works west of Anaconda, and a strong competitor of the Tacoma Smelting Co.

COPPER MILLS SYNDICATE, LTD. **AUSTRALIA.**

Offices: 6, Gresham, St., London, E. C., Eng. Organized March 30, 1906, with capitalization £10,000, to operate in New South Wales, or elsewhere.

COPPER MINES OF MOUNT LYELL WEST, LTD. **TASMANIA.**

Offices: 16, St. Helen's Place, London, E. C., Eng. Mine office: Gormanston, Montagu Co., Tasmania. Chas. McCulloch, chairman; A. G. Ogilvie, mine manager; Herbert A. H. Russell, secretary. Organized Oct. 7, 1897, under laws of Tasmania, with capitalization £400,000; issued £230,000.

Lands, 8 leases, area 70 acres, adjoining the Mt. Lyell Mining & Railway Co., showing several wide ore bodies, assaying 3% to 7% copper, with small gold and silver values. Development is by 2 tunnels. Idle since June, 1904.

COPPER MINES OF SPAIN SYNDICATE, LTD. **SPAIN.**

Did not go to allotment.

COPPER MINES OF TIBET, LTD.

Offices: 5, Great Winchester St., London, E. C., Eng. Capital, fully issued, and all paid in, presumably in cash, £7.

COPPER MINING & DEVELOPING CO. **CALIFORNIA.**

Office: care of J. B. Campbell, president, Fresno, Cal. Lands, 50 claims,

area circa 1,000 acres, 35 miles east of Kaweah, Tulare county, Cali... slightly developed, showing carbonate and sulphide ores, assayi... to 25% copper. Idle, with no prospects of resumption.

COPPER MINING & SMELTING CO. OF ONTARIO, LTD. ON...

Offices: 9, Arundel St., Strand, London, W. C., Eng. Mine office: ... Mines, Algoma, Ont. John Wm. Hughes, chairman; C. E. Osbor... retary; T. Hayes Sheen, general manager; H. J. Carnegie-Williams, ... tendent; A. Cyril Boyce, Frank M. Perry, C. Vefnon Plummer, C... advisory board; Pellew-Harvey & Fell, consulting engineers; Tu... Youngs & Co., British auditors; Clarkson & Cross, Canadian auditors. O... ized August 16, 1905, under laws of Ontario, with capitalization $1,0... shares $5 par.

Property is the old Bruce mines, area 12,800 acres, on Georgian ... Mine was opened 1846 and closed 1876, after producing copper to the v... of $3,300,000. Mine has a depth of 1,500', showing several parallel east ... west veins, traversing diabase, of 4' to 6' average width, carrying sul... ores, mainly chalcopyrite, with quartz gangue. Ore is estimated to av... about 5% copper.

Reduction plant includes a 400-ton concentrator, equipped ... crushers, rolls, jigs, hydraulic sizers, round tables, Griffin mill ... Frue vanners. Estimates have been secured on the first 250-ton unit ... a 500-ton smelter. Miscellaneous improvements include a coal wharf, m... chandise wharf, electric light plant and telephone system. Manage... hopes to blow in the first unit of the smelter early in 1907.

COPPER MOUNTAIN DEVELOPMENT CO. CALIFOR...

Succeeded by Copper Mining & Developing Co.

COPPER MOUNTAIN GROUP. UT...

Office: care of B. T. Lloyd, 323 D. F. Walker Bldg., Salt Lake C... Utah. Mine office: Milford, Beaver Co., Utah. Was owned formerly by ... Copper Mountain Mining & Milling Co. Lands, 6 claims, having open-c... and shallow shafts of 5' to 60', and a main shaft, of peculiar construct... about 250' in depth, showing an iron ore vein of 4' to 14' width, giving ass... of 18% to 28% copper. Shaft is vertical for about 100', thence drops ... at an angle of 75°, thereafter has 50' sunk at an angle of 70°, which is exc... lently bad engineering. Has gasoline power.

COPPER MOUNTAIN MINING CO. CALIFORNIA

Letter returned unclaimed from former office, 310 Laughlin Bldg., Lo... Angeles, Cal. Mine office: Victor, San Bernardino Co., Cal. W. A. Cooper ... president; J. S. Longley, secretary; J. A. Morlan, manager. Lands, 10 claim... including the Amazon mine, showing a 200' gossan outcrop, opened circ... 1873, reopened 1901. Main shaft, 200', shows sulphide ores assayi... 8% to 10% copper. Is said to have about 10,000 tons of ore on t... dump.

COPPER MOUNTAIN MINING CO. NEVAD...

Mine office: Tacoma, Elko Co., Nev. Has steam power. Idle.

COPPER MOUNTAIN MINING CO. **WYOMING.**

Office: care of Dr. C. W. Long, manager, Denver, Colo. Lands, sundry claims, on Copper Mountain, 20 miles southeast of Big Horn, Wyoming, claimed to show a 6″ vein of ore assaying 40% copper, 517 oz. silver and $15 gold per ton.

COPPER MOUNTAIN MINING & DEVELOPMENT CO. **WASHINGTON & BRITISH COLUMBIA.**

Office: 5406 Union Ave., South Tacoma, Wash. Mine offices: Ryan, Stevens Co., Wash., and Quatsino, Atlin district, B. C. B. S. Cowles, president; Jos. Hutchinson, secretary; B. D. Holcomb, general manager; A. T. Macaulay, superintendent. Capitalization $200,000, shares 10 cents par. The property at Ryan is idle. This has 4 claims, area 90 acres, with 3 ore bodies, one lense 75′ wide being opened by a 300′ shaft and a 115′ tunnel. The June group, at Quatsino Sound, includes 5 claims, area 258 acres, showing an ore body said to be 100′ wide, with measured length of 3,000′, giving assays of 6% to 8% copper, 3 oz. silver and $2 gold per ton, from chalcopyrite. A large amount of ore is shown on surface, and the deposit has been worked open-cast. Considered promising, but idle.

COPPER MOUNTAIN MINING & MILLING CO. **UTAH.**

Bankrupt. Property lost, 1904, through bad management.

COPPER MOUNTAIN MINING & SMELTING CO. **MONTANA.**

Mine office: Corbin, Jefferson Co., Mont. J. H. McCabe, manager. Organized, 1904, with capitalization $1,000,000. Lands, circa 50 claims, area about 1,000 acres, on Copper Mountain, near Corbin. Development is by a 200′ shaft, planned to be sunk 500′, and drifts sent from bottom. Shaft encountered numerous stringers of ore, assaying 6% copper, with small silver values. Considerable diamond drill boring has been done also. Presumably idle.

COPPEROPOLIS MINE. **ARIZONA.**

Office: care of Dr. J. M. Ford, Phœnix, Ariz. Mine office: Briggs, Yavapai Co., Ariz. Emery W. Fisher, superintendent. Ores carry copper, silver and lead. Has gasoline power.

COPPEROPOLIS MINE. **MONTANA.**

A property at Copperopolis, Montana, owned by the Daly Mining Co.

COPPEROPOLIS COPPER CO. **OREGON.**

Office: 503 McKay Bldg., Portland, Ore. Mine office: Prairie City, Grant Co., Ore. Employs 10 men. W. W. Gibbs, president and general manager; H. W. Prettyman, vice-president; M. A. Butcher, secretary; Donald Ross, treasurer. Organized 1900, under laws of Oregon, with capitalization $120,000, shares 10 cents par. Lands 10 claims, 2 patented, area 200 acres, with a 2-acre millsite, in the Quartzburg district, showing two fissure veins, between diorite and porphyry, of which one, of 60′ estimated average width, is opened by a 1,500′ tunnel, showing chalcopyrite giving average assays of 3% copper, 1.5 oz. silver and $1.50 gold per ton. Has steam and gasoline power, with a 2-drill air-compressor. The mine has 8 buildings, including a 50x60′ frame concentrator, equipped with crusher, rolls and jigs,

COPPEROSITY MINE. **ARIZONA.**

Mine office: Vekol, Pinal Co., Ariz. Idle.

COPPER PLATE & ARIZONA MINING CO. **ARIZONA,**

Mine office: Metcalf, Graham Co., Ariz. A. Burke, superintendent. Organized, 1904, by Duluth, Minnesota, parties with capitalization $5,000,000, to take over the Copper Plate Group, on Chase creek, said to showa 5′ vein of milling ore in the breast of a 200′ tunnel.

COPPER PRINCE GROUP. **ARIZONA.**

Sundry claims, in the Eureka district of Yavapai county, Arizona.

COPPER PRINCE MINE. **ARIZONA.**

Letter returned unclaimed from former mine office, Kingman, Ariz.

COPPER PRINCE CONSOLIDATED MINING CO. **UTAH.**

Office: care of Clarence K. McCornick, vice-president, Salt Lake City, Utah. Letter returned unclaimed from former mine office, Alta, Salt Lake Co., Utah. Anthony O. Jacobson, president; Chas. H. Post, secretary. Organized 1904, with capitalization $500,000, shares $1 par. Lands, 3 groups of claims, near the Continental-Alta and Columbus Consolidated, from which $900,000 worth of ore has been shipped in the past.

COPPER PRINCE MINING CO. **CALIFORNIA.**

Office: care of J. C. Ruddock, secretary, Ukiah, Cal. Mine office: Middleton, Lake Co., Cal. E. Lobree, president. Lands, 3 claims, opened by tunnel and trenches. A vein of 6′ to 8′ width, in limestone, has given assays of 5% copper, 1 oz. silver and $3 gold per ton. Presumably idle.

COPPER QUEEN CONSOLIDATED MINING CO. **ARIZONA.**

Office: 99 John St., New York. Mine office: Bisbee, Cochise Co., Ariz. Works office: Douglas, Cochise Co., Ariz. Employs about 4,000 men, approximately 1,500 at the smelter and 2,500 at the mine. Jas. Douglas, president; D. Willis James, vice-president; Geo. Notman, secretary and treasurer; Walter Douglas, general manager; S. W. French, assistant manager; Gerald Sherman, mine superintendent; S. W. Clawson, mine foreman, Geo. B. Lee smelter superintendent; W. F. Crane, auditor. Organized August, 1885, under laws of New York, with capitalization $2,000,000, shares $10 par. Is a close corporation, said to have but 14 shareholders.

The mine was opened, 1880, on a solid outcrop of oxidized copper, iron and manganese, opposite the Copper Queen hotel in Bisbee. The original ore body, which has been removed, leaving a large artificial cave, gave average returns of 23% copper and was smelted in a 30″ water-jacket furnace, with English coke, brought via San Francisco, but was exhausted in three or four years, and the mine had many ups and downs, until additional and far larger ore bodies were developed, by following seams and stringers of ore wherever occuring, these almost invariably leading to further large and rich ore deposits. The formation of the Copper Queen, and other mines of the district, consists essentially of two dolomitic limestone beds, of Carboniferous age, the upper white and the lower blue, dipping to the southward and flanking a granite-porphyry core, with intrusive porphyritic horses. Until 1902 the principal ore bodies were found at the base of the upper lime-

stone bed, which is much broken and interrupted by feldspathic, igneous, intrusive rocks, that evidently have a considerable bearing upon the ore deposits, which occur in pockets, lenses, chimmeys, bunches, chutes, veins, stringers, seams—in fact in almost every manner possible, the larger bodies being connected in most cases by small veins, or mere knifeblade seams. The limestone and its included ore bodies have a general pitch to the southeast, somewhat sharper than the pitch of Tombstone Canyon, necessitating deeper and deeper shafts, as distance is made toward the southeast. Extensive bodies of high-grade ore have been found, since 1902, in the underlying limestone strata, and developments prove these underlying ore bodies to be persistent to great depth. All of the Copper Queen's deep shafts are bottomed in disseminated sulphide ores of high grade, consequently the depth of the ore bodies, while already proven great, is conjectural. The mines show numerous beautiful caves, lined with calcite, some of these being of considerable size, and frequently found in close association with good ore bodies. The alteration zone is variable and erratic, as rich oxidized ores have been found on the lowest level, with chalcocite and bornite occuring above azurite, malachite, cuprite and even considerable bodies of native copper. The larger masses of native metal, ranging up to several hundredweights, and even tons, have been found mainly, not in the upper levels, as might have been expected, but at considerable depth. There is much talc and hematite, with frequent occurrences of manganese, in connection with the ore bodies. Only oxidized ores were worked, until 1893, when converters were added to the smelting plant, since which time the furnaces are charged with a mixture of oxide, carbonate and sulphide ores, perhaps one-third of the charges being sulphide ores, the ores smelted giving average returns of better than 7%. The system of assaying used by the mine gives no figures regarding ores richer than 15%, and the frequent occurrence of the figures "15+," on the assay books of every shaft, testifies to the wonderful richness of the ore bodies.

Mining lands are upwards of 1,000 acres, in the Warren district. The various shafts of the mine range from 400′ to 1,200′ depth, and there are five producing shafts, these being the Czar, Holbrook, Spray, Lowell and Gardner, with two developing shafts, the Sacramento and Cuprite, and one idle shaft, the White Tail Deer, also a number of old and small exploratory shafts and pits. The mine is opened ahead for about eight years, and for several years, until 1905, the bulk of the ore smelted came from development work only, the present ore reserves of the mine being among the richest and most extensive ever developed in any property. The ores are so soft that securing the mine openings is a serious problem, as the entire hill above the mine is creeping, and serious crushes can be avoided only by heavy timbering and the exercise of great care. Many of the lower stopes are bulkheaded throughout. The mine is timbered with square sets of 10x10″ and 12x12″ timber, mainly Washington fir, costing $22 per thousand, and an average of 30′ of timber, board measure, is required for each ton of ore won. All ore is hand-sorted underground, after breaking, and culls used for filling in worked-out stopes,

this material standing remarkably well. That the mine, operated under these numerous disadvantages, and menaces to life, is one of the safest in existence for underground workmen, evidences an able and experienced management.

The Czar shaft is the oldest of the present workings, and the principal shops are clustered about this shaft, on a narrow bench of ground made by grading the steep hillside. The Czar is connected underground with the Holbrook, Spray and Gardner shafts, and ultimately all shafts will have numerous connections. The old smelting plant was crowded and inadequate, notwithstanding which it earned many millions of dollars for the Copper Queen company, in the past, doing much better work than its appearance promised.

Lying next southeast of the Czar is the Holbrook shaft, an old and reliable producer that carries very rich ores, and is excessively hot in the lower levels. Considerable trouble is experienced from the settling of ground in the Holbrook openings. Enormous new ore bodies have been opened and developed since 1902, and the Holbrook is the principal producer of the mine. The six-compartment shaft is 500′ deep, with a 100′ winze from the bottom level. Surface equipment includes a steel gallows-frame and 750-h. p. hoist.

Next southeast, and near the Irish Mag shaft of the Calumet & Arizona, is the Silver Spray, commonly known as the Spray shaft, 950′ deep, with three compartments, two carrying 3-deck cages for ore-cars, with a man-way and pipes in the third. The pump station is on the 700′ level. This shaft shows rich ores from the fourth level to the bottom, the upper workings carrying mainly chalcocite, which changes to bornite on the fifth level, with carbonates, oxides and a continuance of sulphide ores shown on the sixth level, both oxidized and sulphide ores occurring on the seventh, and with mainly sulphide ores on the eighth level. The ore bodies are very extensive and persistent, but most erratic in nature, with frequent occurrence of porphyry dykes. A considerable body of native copper was cut on the 700′ and again on the 800′ level, thus setting at defiance some deeply cherished geological theories regarding ore deposition. The pump station is on the 700′ level, and the Spray has underground connection with the Gardner shaft. Surface plant includes a 20x60″ Nordberg Corliss hoist.

The Lowell shaft, southeast of the Irish Mag of the Calumet & Arizona, sunk on a property bought in 1901, is 1,120′ in depth, and underground connections have been secured with the Gardner and Sacramento shafts, for safety and ventilation. No important ore bodies have been opened above the 900′ level, but very large lenses of high-grade sulphide ore have been developed on both the 1,000′ and 1,100′ levels. The 1,000′ level shows high-grade oxides occurring below sulphides. This shaft makes about 175,000 gallons of water daily, which is forked to surface by a Prescott station pump, on the 1,000′ level. The Lowell became a producer in 1904, and has shipped carloads of ore giving smelter returns of 55% copper. The average of the mine is much lower, of course, but is remarkably high. A new 20x60″ Nord-

berg Corliss hoist, similar to those at the Gardner and Spray shafts, is being installed, and will operate three-deck cages.

The Gardner shaft, near the porphyry contact, is 1,100′ deep, with three compartments. Large bodies of high-grade sulphide ores, similar to those of the Lowell, are being developed. The surface equipment includes a 100′ steel gallows-frame and 20x60″ Nordberg Corliss 750-h. p. hoist, similar to those at the Gardner and Spray shafts.

The 3-compartment Sacramento shaft, 2,200′ from the Lowell, started 1904, is sunk on Sacramento Hill, the keystone of the Bisbee copper deposits, and has underground connection with the Lowell, for ventilation and safety. The hoist in use is the old engine from the Lowell.

The Cuprite shaft, lying about 1,400′ west of the Holbrook and Spray, was started 1905, and was 200′ deep in March, 1906. This shaft should cut the extension of the ore bodies opened in the Shattuck-Arizona property.

The White Tail Deer shaft lies some distance south of the main workings, and is reached by road only by a detour of several miles. This shaft was opened on an incline, circa 1893, to a depth of 100′, and the product was hauled to the smelter by a traction engine. Some high-grade ore, shipped by lessees, 1903 and 1904, ranged 12% to 15% copper, and the mine shows a large body of low-grade ore.

A precipitating plant is being built near the old smelter, to treat the water from the Czar shaft, which is heavily charged with copper sulphate in solution. The two monstrous slag-dumps at Bisbee are being broken up, and slags shipped to Douglas, for resmelting.

Fuel for power purposes, at the mine and smelter, is mainly Texas and California petroleum, consumption amounting to about 400,000 gallons monthly. Petroleum has proven cheaper in initial cost, and easier and cleanlier in handling, than coal, in addition to which a great saving of wages is effected by dispensing with the services of a large number of stokers. The shafts and shops are all reached by spurs of the El Paso & Southwestern Railway.

The Douglas Reduction Works, at Douglas, Arizona, 28 miles from the Copper Queen mine, and within a mile of the Mexican border, were designed as the central smelter for the mines of Phelps, Dodge & Co., in Arizona and Mexico, these including the Copper Queen at Bisbee, the Detroit at Morenci, the United Globe and Old Dominion at Globe, the Moctezuma at Nacozari, Sonora, and the Sierra de Cobre at La Cananea, Sonora, Mexico. As these six properties produce a great diversity of copper ores, including those of practically every grade and character found in the southwest and in northern Mexico, it is possible, by means of this central reduction plant, to take the fullest advantage of the varied nature of the ores in mixing the furnace charges. This plant also treats custom ores of copper, gold and silver, and is smelting the ore of the Imperial mine, among others.

The smelting plant, which cost about $3,000,000, is second in size only to the mammoth Washoe works of the Anaconda. Construction was begun May, 1901, and the first stack was blown in, March, 1904. The works are

constantly being increased in size, although originally planned to do for a generation, without additions. Present daily capacity is about 3,000 tons, which is to be increased.

The works have 15 miles of railroad, including main line and side-tracks. Ore is received from the mine in side-dumping steel cars, and discharged into 3 ore pits, each 12′ deep, 38′ wide and 765′ long, lined with white tufa, these pits being of 10,000 tons capacity each. Ore is removed, as needed, by steam shovels. Adjoining the furnace building is a steel trestle, 48′ high and 1,343′ long, divided into sections, with bins for coke, fluxes and silica. Ore storage facilities were increased 50% in 1905.

A sampling mill, 75x160′, built 1905, is supplied with a most complete and modern equipment.

The steel furnace building, originally 150x396′, was greatly increased in size in 1905. This originally had five 42x204″ water-jacket blast-furnaces, of 250 tons daily capacity each, but these were being torn down in the spring of 1906, and enlarged to 350 tons capacity each. Three 42x120″ blast-furnaces, from the old smelter at Bisbee, have been installed in the western end of the new plant. Three new 42x240″ furnaces, of 350 tons daily capacity each, are being added, the first of these being blown in, December, 1905. Each blast-furnace has a separate settler. In addition to the blast-furnaces, there are to be three large reverberatory furnaces, to treat the blast-furnace slags, flue-dust and fines, the first of these being installed in the slag-yard south of No. 6 blast-furnace.

Molten matte is taken from the blast-furnaces to converters by two 60-ton electric traveling cranes, each of which has two 15-ton auxiliary hoists. Capacity of the converter plant was increased, 1905, to seven stands, equipped with monstrous shells of the Copper Queen horizontal barrel type, each 96x136″. Blast for the converters is furnished by six 30x42″ Nordberg cross-compound duplex condensing air-compressors. A new blast-main has been installed for the converter blast, the six compressors having an aggregate capacity of 45,000 cubic feet of free air per minute. The converter department is supplied with a silica-mill and briquetting plant. The main stack of the furnace building is 30′ diameter at the base, 25′ at the top, and 200′ high.

The steel power-house, enlarged, 1905, to 210x250′, has 17 engines of various sizes and types, for various uses, with an aggregate of about 6,000 horse power. The plant includes blowers for the blast furnaces, air-compressors for the converters, and a cross-compound two-stage condensing air-compressor, with capacity to reduce 2,000 cubic feet of free air per minute to 100 lbs. pressure per square inch. The electric plant has four 250-volt 400-kw. direct current generators, supplying power for the traveling cranes, slag-locomotives and electric light. Slags from the blast-furnaces are handled by electric locomotives, hauling dump-cars traversing standard-gauge railroad tracks.

An 85x208′ steel boiler-house has six 500-h. p. and one 1,000-h. p. Stirling water-tube boilers, with a Green fuel economizer, and a Foster super-

heater designed for 90,000 lbs. of steam per hour. The boilers are arranged to burn either coal or petroleum, but the latter is used almost exclusively. The main stack of the power-house is of brick, 13′ in diameter and 177′ high, surmounted by 4 lightning-rods.

The 80x204′ machine-shop, of steel, is fitted with a very complete line of shop tools, and is equipped to handle the heaviest work. The 85x120′ boiler-shop, of steel, is calculated to do any work required, and, if necessary, can repair locomotives. In connection with the boiler-shop is a large smithy, also thoroughly equipped. An 80x120′ foundry is prepared to turn out castings of all size, from the smallest to those of many tons in weight.

Water for the smelting plant is secured from artesian wells, and a flowing well was brought in, late in 1905. A large reservoir and cooling tower have been constructed for the water.

The El Paso & Southwestern railroad, owned by Phelps, Dodge & Co., which serves the Copper Queen mine and smelter, has some 300 miles of main lines, with considerable trackage in spurs and sidings, and while designed solely as an outlet for the Phelps-Dodge mines, has developed a previously inaccessible district, rich in natural resources, and its business has increased in a manner astonishing to even the most optimistic. One result of the construction of this line is the building of the new town of Douglas, named in deserved honor of Prof. James Douglas, which is a bustling young metropolis of some 9,000 souls, apparently destined to become a strong competitor of El Paso, as a custom smelting point for the ores of Arizona, New Mexico, Sonora and Chihuahua.

The miscellaneous enterprises of the Copper Queen include a sawmill in the Chiricahua Mountains, and an enormous department store that carries a stock and does a business that would do credit to any city of several times the population of Bisbee. There is, however, no compulsion of the employes, who are at perfect liberty to buy their goods at any of the numerous independent mercantile establishments. The company maintains a large and well equipped hospital, a fine four-story hotel, a large library and reading room, and a handsome three-story gymnasium supplied with baths, bowling alleys and having a large auditorium, in which scientific and popular lectures are given frequently.

Relations of the Copper Queen with its workmen are notably cordial. The wages of underground workmen are $3.50 to $4.00 per day, for eight-hour shifts, and these wages and hours were established voluntarily, many years before the first miners' union was heard of in the southwest. The Queen has been free from labor troubles, of any sort, for almost a generation. Efforts have been made at various times to unionize the camp, but early in 1906 a referendum vote of the mine workers of Bisbee was taken on this point, no bosses or other salaried employes being allowed to vote. The polling was conducted on the Australian system, with complete poll-lists, inspectors and guards, the voting being surrounded by all the safeguards found at a political election. The vote of the miners of the Copper

Queen, Calumet & Arizona and other mines of Bisbee, was more to one against forming a union of the Western Federation of M

The smelter, which runs three eight-hour shifts, has a possibl of 10,000,000 lbs. to 12,000,000 lbs. fine copper monthly, and i 1906, the production was 7,696,000 lbs. fine copper, this including uct of refractory ores from Globe, Imperial ores and Nacozari co as well as the ores of the Copper Queen. The two old slag-piles containing approximately 1,000,000 tons running about 2% c being broken up and resmelted. The new reduction plant, which w in 1901 to care for the company's business for decade or out enlargement, has been nearly doubled in size since going in sion, in 1904, and the end of its rapid growth does not seem to as yet, the Copper Queen alone being capable of a production o quite 100,000,000 lbs. fine copper yearly. Production, 1905, was lbs. fine copper.

The broad and generous management of the Copper Queen not be too highly commended. This is shown, not only in the skill with which the properties are managed, but also in the relat company with neighboring mines, with its employes, and with people of Bisbee and Douglas. The railroad controlled by the agement has been of incalculable benefit in building up the resou territory along its line, and new enterprises have been fostered b ing of low freight-rates, and by aid of a practical nature in other The public spirit and philanthropy of the company are shown by donations to all local enterprises, and by the aiding of every calculated to promote the mental, moral and material welfare o cities, with an aggregate population of 25,000 people, that have about its mines and smelters.

COPPER QUEEN CONSOLIDATED MINING CO. V

Letter returned unclaimed from former mine office, Dillon, W

COPPER QUEEN CONSOLIDATED MINING & MILLING CO.

Office: 500 Auerbach Bldg., Salt Lake City, Utah. Moribun

COPPER QUEEN GROUP MINING CO. C

Office: care of B. S. Koll, 723 Odd Fellows Bldg., St. Louis, talization $1,000,000, shares $1 par. Lands, 7 claims, in the Elk district, Gunnison county, Colorado. Has been idle several years, planned to develop the property through extension of a tunnel b by the Success Gold Mining Co.

COPPER QUEEN, LTD. BRITISH CO

Dissolved, August, 1904.

COPPER QUEEN MINE. A

Letter returned unclaimed from former mine office, Rivers

COPPER QUEEN MINE. A

Mine office: Stoddard, Yavapai Co., Arizona. Has a tunnel auriferous copper ore. Presumably idle.

COPPER QUEEN MINE. **BRITISH COLUMBIA.**

Mine office: Van Anda, Texada Island, B. C. Idle for several years.

COPPER QUEEN MINE. **CALIFORNIA.**

Office: care of Joseph Hutchens, owner, Anada, Cal. Lands, 6 claims, 35 miles southeast of Bridgeville, Humboldt county, California, developed by open-cuts and a 40′ shaft, showing sulphide ore.

COPPER QUEEN MINE. **CALIFORNIA.**

Office and mine: care of G. H. Hamstadt, Nipton, San Bernardino Co, Cal. Property has made several small shipments of selected high-grade ore.

COPPER QUEEN MINE. **CALIFORNIA.**

An idle property, opened by a 350′ tunnel, in the Pit River district, Shasta county, California.

COPPER QUEEN MINE. **COLORADO.**

A prospect in Larimer county, Colorado, near the Wyoming line, opened by a 95′ shaft showing a 3′ vein of chalcopyrite of smelting grade. Is developing with a small force.

COPPER QUEEN MINE. **COLORADO.**

Lands, 160 acres, on Sultan Mountain, San Juan county, Colorado, opened by a 70′ tunnel, following the contact, which shows ore assaying 15% copper and $25 gold per ton, with small silver values.

COPPER QUEEN MINE. **NEW MEXICO.**

Mine office: Jarilla, Otero Co., N. M. Wm. Wade, manager. Lands, sundry claims in the northern part of the Jarilla Mountains, which, at the close of 1905, were showing ore assaying 5% to 10% copper, with small gold and silver values.

COPPER QUEEN MINE. **SOUTH DAKOTA.**

A prospect, near Custer Peak, South Dakota, on which an 80′ shaft shows some ore of fair grade.

COPPER QUEEN MINING CO.

Dead. Former office was 542 Rookery Bldg., Spokane, Wash.

COPPER QUEEN MINING CO. OF ALASKA. **ALASKA.**

Neither office nor lands located.

COPPER QUEEN MINING CO., LTD. **ONTARIO.**

Succeeded, 1905, by Calumet & Algoma Mining Co.

COPPER QUEEN MINING & SMELTING CO. **IDAHO.**

Office: 409 Providence Bldg., Duluth, Minn. Mine office: Grant, Beaverhead Co., Mont. Employs 18 men. T. E. G. Lynch, president; B. F. White vice-president; A. J. McLennan, secretary and treasurer; Geo. H. Crosby, general manager; A. K. McDaniel, superintendent; preceding officers, Dr. C. W. McFadden and J. C. McFadden, directors. Organized June 12, 1905, under laws of Arizona, with capitalization $500,000, shares $1 par. Lands, 8 claims, area circa 150 acres, carrying 8 fissure veins in schistose quartzite, of which 3 are more or less developed, these ranging from 15″ to 15′ average width, showing chalcocite, bornite and occasional chalcopyrite, giving average assays of 15% copper, 5 oz. to 10 oz. silver and $15 gold per ton. Development is by shafts of 100′ and 140′, and by tunnels of 30′, 50′, 75′, 110′, 160′, 180′ and 425′.

Equipment includes a steam plant with 3 boilers, 2 hoists, 3-drill Rand air-compressor and 2 power drills. There are 10 buildings, including a log mill having 5 gravity stamps, 2 concentrators and 6 canvas tables. Property is 38 miles from the Oregon Short Line railway. Company plans continuing development work underground, and installing a 100-ton concentrator. Management is good and property is regarded as promising.

COPPER RANCH GOLD MINING & MILLING CO. **COLORADO.**

Office: 1711 Tremont St., Denver, Colo. Capitalization $1,000,000, shares $1 par. Lands, 170 acres, patented, in Boulder county, Colorado, opened by a 218′ shaft, with 350′ of drifts. In February, 1906, was advertising its property as a tungsten mine.

COPPER RANCH MINING CO. **UTAH.**

Office: 323 D. F. Walker Bldg., Salt Lake City, Utah. Letter returned unclaimed from former mine office, Milford, Beaver Co., Utah. Moses Thatcher, president; C. L. Rood, vice-president; Benj. T. Lloyd, secretary and treasurer. Organized under laws of Utah, with capitalization $500,000, shares 50 cents par. Lands, 17 claims, area circa 340 acres, between the Old Hickory and O. K. mines of the Majestic company, carrying about 2 miles of outcrop along the strike of the vein, which apparently is about 100′ wide, and has been developed, at intervals, for a distance of about one mile. Assays have ranged from 7% to 43% copper, 7 oz. to 10 oz. silver and $2.25 to $8 gold per ton. It is estimated by the management that the entire vein will average 4% to 7% copper, with fair gold and silver values. Idle, and lacks funds for development. Property regarded as valuable, if properly financed and managed.

COPPER RANGE CO. **MICHIGAN.**

Office: 27 State St., Boston, Mass. Mine office: Painesdale, Houghton Co., Mich. Wm. A. Paine, president; Frederic Stanwood, secretary and treasurer; preceding officers, Chas. A. Snow, Jas. H. Seager and Cameron Currie, directors; F. W. Denton, general manager. Organized 1899, under laws of Michigan, with capitalization $2,500,000, shares $25 par. Is controlled, through ownership of 99,674 shares out of 100,000, by the Copper Range Consolidated Co. Holdings of the Copper Range Co. consist of 50,000 shares Champion Copper Co., being one-half the total issue, 26,051 shares Copper Range, R. R. Co., 9,360 acres of mineral lands, sundry timber lands, bought for $73,560.88, and a millsite. Company's income, for 1905, was $514,472.28, of which $500,000 came from dividends of the Champion Copper Co., and disbursements included $172,006.49 for bills payable redeemed, and $300,000 in dividends, later being $1.50 per share, Oct. 4, 1905, and $1.50 per share, Dec. 21, 1905. Company ended 1905 with $34,060.87 cash on hand, and with liabilities of only $2,139.70.

Landed holdings include 9,360 acres, in a compact tract south of the Baltic mine, in Town 54 North, Range 34 West, and Town 54 North, Range 35 West, including 9,360 acres on the mineral belt, south of the Baltic, something more than 5,000 acres being located on the mineral belt. The company also holds an option on 2,000 acres of mineral land owned by St. Mary's Canal Mineral Land Co., in the immediate neighborhood of its own holdings. Miscellaneous

lands include 441 acres, with nearly 4 miles frontage on Lake Superior, near the mouth of the Graveraet river, 3 miles southwest of the Champion mill, at Freda, sufficient to give sites to three or four new stampmills.

COPPER RANGE CONSOLIDATED CO. **MICHIGAN.**

Office: ~~27 State St.~~, Boston, Mass. Mine office: Painesdale, Houghton Co., Mich. Railroad office: Houghton, Houghton Co., Mich. Wm. A. Paine, president; Frederic Stanwood, secretary and treasurer; F. W. Denton, general manager of mines; preceding officers, Cameron Currie, J. Henry Brooks, R. Townsend McKeever, Samuel L. Smith, Chas. H. Paine and Kenneth K. McLaren, directors; John M. Wagner, purchasing agent.

Organized November, 1901, under laws of New Jersey, and capitalization increased, 1903, to $38,500,000, shares $100 par; issued, $38,413,500. Is a securities holding corporation, owning only stock in subsidiary companies, these including the Copper Range Co., Copper Range Railroad Co., Baltic Mining Co. and Trimountain Mining Co., all of which are practically owned outright, also a one-half interest in the Champion Copper Co. and a large interest in the Michigan Smelting Co., and control of the Globe mine, now undergoing development. All of the subsidiary corporations heretofore named are separately described, under their respective titles. Company's balance sheet, of Jan. 1, 1906, showed stockholdings as follows: 99,674 shares Copper Range Co; 13,986 shares Copper Range, R. R. Co.; 99,659 shares Baltic Mining Co., and 791 unissued shares of Copper Range Consolidated Co., latter held subject to issue in exchange for outstanding shares of the Baltic Mining Co. and Copper Range Co. Assets also included $615,000 bonds of Copper Range R. R. Co.; $114,000 notes of Champion Copper Co.; $188,350.15 notes of Michigan Smelting Co., and $100,000 notes of Trimountain Mining Co. The balance sheet also included items of $104,534.64 for the Globe mine, for expenditures made thereon; $305,703.45 due from Trimountain Mining Co., apparently on open account; $74,865.33 Trimountain Mining Co., indebtedness of Trimountain Mining Co. on surplus account, and a balance of $540,542.49 due from former majority shareholders of the Trimountain Mining Co., under the merger agreement of Aug. 25, 1903. The balance sheet also showed $34,032.91 in accounts receiveable, and $335,928.53 cash. Liabilities included Trimountain Mining Co., suspense, $540,542.49; Trimountain Mining Co., on deposit, $534,469.04; Baltic Mining Co., on deposit, $151,762.50; Copper Range Co., on deposit, $33,000 and Copper Range R. R. Co., on deposit, $60,000, with a balance to Profit and Loss of $1,091,753.47. Dividends were begun, 1905, and aggregated $1,536,086 for the year. Disbursements included $50,000 paid for an option on the Globe mine, and $54,534.64 cash expended on exploratory and development work at the Globe

Through its subsidiary corporations the Copper Range Consolidated Co. has become the second largest copper producer of the Lake Superior district, the production of the Baltic, Trimountain and Champion mines for 1905, having been 40,568,572 lbs. fine copper, of which amount the share of the Copper Range Consolidated Co. was 32,714,859 lbs. The mines controlled by this company are all young and vigorous, and have by no means reached the

limit of their productive capacity. The Globe may add a fourth big mine, but even though this be not accomplished, it is a reasonably safe assertion to state that the Baltic, Trimountain and Champion mines, collectively, carry more copper, and eventually will produce more copper, than the Calumet & Hecla mine proper, and should produce it at nearly as great a profit per pound. The management of the Copper Range is among the most aggressive and capable engaged in the copper industry, and future forecasts necessarily are of a most roseate hue.

COPPER RANGE RAILROAD CO. **MICHIGAN.**

Office: 27 State St., Boston, Mass. Operating office: Houghton, Houghton Co., Mich. Wm. A. Paine, president; R. Townsend, McKeever, vice-president, general manager and assistant secretary and treasurer; Frederic Stanwood, secretary and treasurer; preceding officers, John H. Rice, Jas. H. Seager, Frank McM. Stanton, Rufus R. Goodell, Samuel L. Smith and Cameron Currie, directors. Organized 1899, under the laws of Michigan, with capitalization $5,000,000, shares $100 par; issued, $4,093,700. Bonds outstanding, $2,025,000, at 5%. Is authorized to issue bonds to the extent of $20,000 per mile of completed main line and $15,000 per mile of completed branch lines and side tracks. Road has 105 miles of main line and branch track, main line running from Calumet to Mass. Connections are with the Keweenaw Central line at Calumet, Duluth South Shore & Atlantic, Mineral Range and Hancock & Calumet lines, at Houghton and Hancock, and with the Chicago Milwaukee & St. Paul line, at Mass. The district between Houghton and Mass was practically a wilderness, for 38 of the 42 miles, when the Copper Range Railroad was built, in 1899, but is now well populated, and the road is running a suburban train service from Houghton to towns occupying sites that were covered by the forest primeval when this road was constructed. The bulk of the freight business of the line is in the carrying of copper rock from the mines to the mills, but in addition large shipments of timber, fuel and general merchandise are carried, and the passenger business has developed phenomenally. In addition to the main line, the two principal branches are the Painesdale branch, reaching the Baltic, Trimountain and Champion mines, and the Lake Shore branch, serving the stamp-mills along the shore of Lake Superior. Equipment includes 20 locomotives and 346 cars of various types.

The company owns a half interest in a railroad bridge crossing Portage Lake, between Houghton and Hancock. An extensive water frontage on Portage Lake, in the western part of Houghton, is improved by a two-story stone and brick general office building, shops, roundhouse, warehouses and wharves for merchandise and coal. The coal wharf is equipped with modern unloading machinery, and has deep water alongside, being capable of accommodating the largest freighters plying the great lakes.

To Dec. 31, 1905, the railroad cost $5,642,593.25, with an outlay of $551,048.77 for equipment. Earnings, for 1905, were $498,361.27 from freight, $113,279.01 from passenger service, and $47,612.58 from miscellaneous sources, giving a total income of $659,252.86, with total operating expenses of $378,261.13. Taxes and interest on bonds amounted to $123,259.06,

leaving surplus earnings of $157,732,67, equal to nearly 4% on the outstanding share capital. The road is in fine physical condition, and the manner in which it has been developed is a great credit to its management.

COPPER RIVER MINING CO. **ALASKA.**

Office: 1347-25 Broad St., New York. F. M. Bradshaw, president; F. C. Helm, secretary and treasurer; preceding officers, Hon. W. F. Bay Stewart, Hon. Robt. Gwynne, Jr. and John Q. Denny, directors. Capitalization $50,000,000. Lands, alleged to be 188 claims, area 2,360 acres, and also lays claim, without the slightest ground, to 12 other claims, area 240 acres, owned by the Alaska Copper & Coal Co. Lands, if any, are located about 185 miles inland, by trail, from Valdez, Alaska, and are claimed to have "plenty of wood and water, with coal in the vicinity," the timber being a sparse growth of spruce and cottonwood, and the coal lignite. Properties claimed by this company include the Bonanza, Nicholai, Kinnecot and Jumbo groups. The Bonanza group, as before stated is not owned by the Copper River Mining Co. The Kinnecot group has 31 claims, 5 miles from the headwaters of the Kinnecot river, in the Kinnecot mountains. The Nicholai group, 7 claims, 7 miles from the Kinnecot, is said to show a fissure vein. Company and its alleged property are fully described in Vol. IV. The Copper River Mining Co. is a brazen swindle, and its promoters should be in jail.

COPPER ROCK GOLD MINING & MILLING CO. **COLORADO & WYOMING.**

Office: 105 North 7th St., St. Louis, Mo. Mine offices: Sunset, Boulder Co., Colo., and Encampment, Carbon, Co., Wyo. H. Lee Servoss, president; Dan G. Kirshbaum, secretary and manager; Emory Young, superintendent. Capitalization $1,500,000, shares $1 par. The Colorado property, 60 acres, in the Sugar Loaf district, near Sunset, has a 300′ shaft, showing ores carrying good assay values in copper, gold and silver. The Wyoming property, 120 acres, known as the Copper Link group, has a 200′ shaft, showing a little leached ore, with an 8x10″ hoist, and a sawmill, and is sinking a new shaft. The Wyoming claims are considered promising.

COPPER ROCK & GOLD QUARTZ MINING CO. **ARIZONA.**

Letter returned unclaimed from former mine office, Bisbee, Cochise, Co., Ariz. Lands, sundry claims on the porphyry side of Tombstone cañon, on which only annual assessment work has been done.

COPPER SECURITIES CO. **MONTANA.**

Office: 42 Broadway, New York. F. August Heinze, general manager. Organized, 1905, under laws of New Jersey, with capitalization $10,000,000, shares $10 par. Holds one-half the stock issue of La France Copper Co., and presumably is to take the balance. Was organized solely as a securities holding corporation.

COPPER SELECTION SYNDICATE, LTD. **AUSTRALIA.**

Offices: Broad Street House, London, E. C., Eng. Organized August 22, 1902, with capitalization £15,000, in 14,000 ordinary £1 shares and 20,000 deferred 1s. shares. Property was options on sundry mining and smelting properties, in New South Wales. Apparently moribund.

COPPER STAR MINING CO. **COLORADO.**

Dead. Eugene B. Estes was president, and Edwin Wallace secretary and general manager. Paid dividends while peddling stock, and smashed, like all other companies that are rotten before they are ripe.

COPPER STATE MINING CO. **WYOMING.**

Letter returned unclaimed from former mine office, Encampment, Wyo.

COPPER STATE & RED METAL CLAIMS. **MONTANA.**

Mine office: Stone, Granite Co., Montana. Are said to show ore assaying 17% copper. Idle.

COPPERTOWN MINING & SMELTING CO. **CALIFORNIA.**

Office: 211 Examiner Bldg., San Francisco, Cal. Mine office: Hornitos, Mariposa Co., Cal. C. H. Street, president; T. J. Kerrigan, superintendent. Capitalization $250,000, shares $1 par. Property is known as La Victoria mine, which has 3 shafts, each of about 200′, also a 400′ tunnel. Vein matter, with a heavy gossan capping, 300′ to 600′ wide, is of schistose diabase, between grano-diorite walls, showing cuprite, malachite, azurite, bornite and tetrahedrite. All ores, including the gossan, are more or less auriferous. Was a considerable producer, circa 1865, employing 300 men. Company also owns the Hope mine, near Sonora, Tuolumne county, California, which is a gold mine with a 10-stamp mill.

COPPER TRUST, LTD.

Offices: 20, Laurence Lane, London, E. C., Eng. Organized December 9, 1905, with capitalization £50,000, shares £1 par. Apparently owns no mining property.

COPPER TRUST MINING CO.

Letters returned unclaimed from former office, Plankinton Bank Bldg., Milwaukee, Wis.

COPPER VEIL MINING CO. **WASHINGTON.**

Letter returned unclaimed from former mine office, Index, Snohomish Co., Wash. Lands, said to be 52 claims, with 6 tunnels, longest 250′.

COPPER VENTURE SYNDICATE, LTD.

Voluntarily liquidated, June, 1905.

COPPER VERDE MINE. **COLORADO.**

Office, care of G. W. Chance & Co., Philadelphia, Pa. Lands, sundry claims on the Colorado Midland railway, 9 miles from Lake George, Park county, Colorado, said to show a large body of auriferous copper ore.

COPPER WORLD EXTENSION MINING CO. **WASHINGTON.**

Office: 503 New Hayden Bldg., Columbus, Ohio. Mine office: Loomis, Okanogan Co., Wash. Employs 20 men. Walter A. Boyle, president; Edw. H. Caylor, vice-president; Alfred F. Carman, secretary and treasurer; Henry Bahrs, superintendent; preceding officers, Saml. Bachtell and Clarence E. Ferree, directors. Organized January, 1905, under laws of Washington, with capitalization $1,500,000, shares $1 par. Lands, 8 claims, area 160 acres, on Palmer Mountain, in the Wannicut Lake district, showing a very wide ore body, estimated by company to be 100′ to 300′ in width, opened by a 210′ shaft, with south crosscut on the 210′ level showing a 17′ body of chalcopyrite of apparently

about 8% average tenor. Main working shaft has two compartments. Ores carry 4 oz. silver and $1.40 gold per ton, and upwards. Has a steam plant with 2 hoists, good for 500' each, and a 5-drill air-compressor. Lands are surveyed for patents. Management seems good, and property is considered promising.

COPPER WORLD GOLD MINING CO. **WASHINGTON.**

Office: care of Jerome L. Drumheller, Spokane, Wash. Mine office: Loomis, Okanogan Co., Wash. John Wentworth superintendent. Apparently succeeded the Copper World Mining & Smelting Co. Lands, sundry claims on the apex of Palmer Mountain, lying between lands of the Copper World Extension and Leadville mines, 4½ miles northeast of Loomis, showing a 100' gossan, with iron pyrites near surface and chalcopyrite at a little depth. Has several shallow shafts and short tunnels, showing ore giving assay values of $10 to $15 per ton, in copper, gold and silver.

COPPER WORLD MINING CO. **CALIFORNIA.**

Dead. Described in Vols. IV. and V.

COPPER WORLD MINING CO. **NORTH CAROLINA.**

Merged, 1903, in Carolina King Mining Co.

COPPER WORLD MINING & SMELTING CO. **WASHINGTON.**

Apparently succeeded by Copper World Gold Mining Co.

COPPER ZONE MINING CO. **NEW MEXICO.**

Dead. Company was dispossessed of its lands.

SOCIEDAD MINERA COQUIMBANA. **CHILE.**

Mine office: La Serena, Coquimbo, Chile. Property includes the Rosario, Socavon and other mines. Idle at last accounts.

CORRA-ROCK ISLAND MINING CO. **MONTANA.**

Property sold, 1906, to Butte Coalition Mining Co.

CORBIN COPPER MINING CO. **MONTANA.**

Apparently an incorrect title or else probably succeeded by Corbin-Montana Mines Co.

CORBIN MINE. **ALASKA.**

Office: care of Harry Corbin, Coppermount, Prince of Wales Island, Alaska. Lands are about half way between Coppermount and Sulzer. Mine shows high grade ore, in promising quantities, and some ore was shipped to the Coppermount smelter, in 1905. Employs 10 men.

CORBIN-MONTANA MINES CO. **MONTANA.**

Office: care of Clarence K. McCornick, vice-president and general manager, Salt Lake City, Utah. Mine office: Corbin, Jefferson Co., Mont. Arthur H. S. Bird, president; C. H. Post, secretary-treasurer; preceding officers, H. A. McCornick, and B. T. King, directors. Organized 1904, under laws of Utah, with capitalization $600,000, shares $2 par. Lands, sundry claims in the vicinity of Corbin, which were diamond-drilled in winter of 1904-5. Presumably idle.

MINA CORDENERA. **MEXICO.**

Mine office: Suaqui Grande, Sonora, Mex. W. S. Morrow, manager, at last accounts. Ores carry silver and copper. Has steam power and a 5-stamp mill. Presumably idle.

CORDILLERO MINING CO. **BRITISH COLUMBIA.**

Office: care of A. W. More, 332 Lumber Exchange, Seattle, Wash. Alfred Raper, manager. Lands, 3 claims, adjoining the Cornell mine, on Texada Island, British Columbia. Company bonded the Cornell mine, in 1905, and was operating same at close of the year.

CORDOBA EXPLORATION CO., LTD. **SPAIN.**

Copper property was sold, May, 1903, to Cerro Muriano Mines, Ltd.

GEWERKSCHAFT CORIOLAN. **GERMANY.**

Mine office: Wissen am Sieg, Rheinprovinz, Germany. Has one shaft. Ores carry lead, copper, antimony and cobalt.

CORK MINERAL DEVELOPMENT SYNDICATE, LTD. **IRELAND.**

Offices: 9, Gracechurch St., London, E. C., Eng. A. J. M. Brown, secretary. Organized June 22, 1903, with capitalization £15,000, shares £1 par, issued, £13,704, to lease for 31 years a tract of 1,040 acres of copper-bearing ground on Mount Gabriel, County Cork, Ireland.

CORNELIA COPPER CO. **ARIZONA.**

Office. 802 Fullerton Bldg., St. Louis, Mo. Mine office: Gila Bend, Pima Co, Ariz. C. W. Chamberlain, president and treasurer; H. W. Mann, vice-president; John R. Boddie, secretary; A. J. Shotwell, manager. Organized May 14, 1900, under laws laws of Arizona, with capitalization $100,000, shares $10 par. Is closely connected in management and ownership with the Rescue Copper Co., and apparently is some relation to the Shotwell mine and the Shotwell-Trimountain Copper Co. Lands, 6 patented claims, area 100 acres, developed by shafts of 125′ and 225′, and by tunnels of 30′ and 60′. Company claims to have in sight 25,000,000 tons of ore, averaging 10% copper, with gold and silver values, which is an excessive estimate. Mine has a small steam plant. At the beginning of 1906 the company planned installing a smelter. The prospectus of the company is authority for the assertion that, at a meeting of interested parties, Mr. F. L. McGahan stated as follows:

"In treating and smelting mineral ores and iron in a vacuum, the nitrogen in the air is excluded from coming in contact with same, practically eliminating all slag and the necessity of fluxing, furthermore none of the vapors or fumes being allowed to escape, the full values contained in the ores are secured, thus every bit of carbon and other volatile substance forming fuel quantities uniting with the pure ox-hydrogen, whereby great economy is secured in the reduction of all ores.

"In addition to this many other minerals are saved, which under the present systems of smelting are destroyed or allowed to escape through the stacks.

"Ox-hydrogen gas is produced out of water by super-heating steam and by introducing this gas combined with a small amount of carbon into a vacuum the phenomena of perfect combustion is produced—the hydrogen flame—at once the greatest heat agent known to science and the cheapest fuel obtainable.

"This gas will burn in the vacuum forming a perfect heat arc (similar to that in the present electric furnace) and will produce a degree of heat sufficient to volatilize any known material.

"The ores are treated just as taken from the mines and there is no expense of crushing, and the values are extracted as chemically pure and condensed metals. The gold and silver being pure bullion bars, can be sent direct to the mints, and coined when properly tempered."

"Five to twenty per cent more of the values in the ores are extracted and at a cost not exceeding one-half as compared to the present methods of smelting."

"Iron is also treated by this system and a homogeneous steel of the finest grade made out of same at a great reduction of the present cost, or it can be run out of the furnace, moulded and cast into a malleable iron requiring no annealing."

The prospectus adds to this statement:

"Enough has been said here to convince the most skeptical that the inventor, Mr. F. L. McGahan, is not only an inventor, but a metallurgical scientist of national repute."

These most remarkable discoveries by Prof. McGahan are nothing less than epochal. At a single blow Prof. McGahan has demolished the entire fabric of chemistry and physics, built up with such painstaking labor during the last two thousand years. The doctrine of the conservation of energy, which has been given general acceptance for two generations, is shown to be utterly fallacious, by the fact that Prof. McGahan will dissociate the atoms of oxygen and hydrogen contained in water, and, by reassociating the same, will secure the cheapest fuel known. This great feat neatly solves the mooted question of perpetual motion. The entire fabric of chemistry is thrown down by Prof. McGahan's discovery that nitrogen is the poisonous element in furnace practice. Heretofore all chemists and metallurgists have considered nitrogen the most inert of chemical elements—in fact, have carried their folly to the point of basing all high explosives upon the alleged well-known tendency of nitrogen to form unstable compounds. Doubtless it will be impossible to manufacture dynamite and gun-cotton hereafter, as soon as the chemical elements learn that their inmost secrets have been discovered by Prof. McGahan, and that nitrogen, that most wicked, active and deleterious of elements, has been masquerading until now as a harmless and passive gas.

The chemical reactions that will take place in the vacuum of Prof. McGahan's furnace afford an interesting field for conjecture. As oxygen and hydrogen gases, when burned together, form water, and as the smelting is to be done in a vacuum, the water so formed doubtless will have a powerful solvent effect on the metals contained in the charge.

The discovery that oxygen and hydrogen gases can be formed by superheating steam is most important. All that will be required hereafter for power plants will be to install a properly equipped boiler beside or astraddle a spring or stream, evaporate the water into steam, superheat the steam, and touch a match to the product.

The ultimate secrets of alchemy have been unlocked also by Prof. McGahan. By shutting out the poisonous nitrogen, slags are practically eliminated. As the smelting is done in a vacuum and nothing can escape except through the vent for the metals, and as practically no slags remain, it is evident that every-

thing in the ore is turned into metals. By this simple plan, ore of the very lowest grade will return practically 100% in copper, gold and silver.

The discovery that an oxy-hydrogen flame, burned in a vacuum, will give a heat similar to that of the electric arc, will, of course, destroy all the industries that have been built up at Niagara Falls by the use of the electric arc.

Inasmuch as all values are extracted as chemically pure and condensed metals, (the condensation of metals being a new thing also) the gold and silver being pure bullion bars, all of the electrolytic refining plants of the world will be forced to go out of business.

It is evident that the mints of the United States and foreign countries have been run on very loose principles, as the product of the McGahan vacuumizer, as the inventor terms his new furnace, can be sent direct to the mints and coined "when properly tempered." Heretofore the coiners have not tempered the bullion bars used for coin, nor have they coined chemically pure gold and silver, but have alloyed the same. For thus debasing the currency, the Director of the Mint should be impeached. It is quite evident, from the wonderful discoveries made by Prof. McGahan, that all of the metallurgists from the time of Tubal Cain to Bessemer have been nincompoops, but it remained for that eminent scientist, Prof. F. L. McGahan, of the Arizona Independent Vacuum Smelting Co., with its head offices in that important metallurgical center, Ft. Smith, Arkansas, to demonstrate this fact, and to utterly demolish the entire fabric of science, by the most remarkable discoveries of this or any other century.

CORNELL GOLD, SILVER & COPPER MINING CO. **NEW MEXICO.**

Mine office: Silver City, Grant Co., N. M. Frank F. Ross, secretary. Lands, including the Owl mine, are in the Gold Gulch district. Idle.

CORNELL MINE. **BRITISH COLUMBIA.**

Under bond to Cordillero Mining Co.

MINA EL CORNETA. **MEXICO.**

Mine office: care of Henry Winninghoff, owner, San Miguel Mezquital, Zacatecas, Mexico.

CORNETT MINE. **CALIFORNIA.**

Office and mine: care of H. W. Cornett, owner, Merced, Mariposa Co., Cal. Vein matter is schistose diabase, with a 3′ paystreak carrying ore, mainly chalcopyrite, assaying 17% to 23% copper, and $2.25 to $4.50 gold per ton. Idle.

CORNISH COPPER CO.

Office: care of Andrew B. Hardryx, New Haven, Conn. Organized December, 1903, under laws of Connecticut, with capitalization $300,000.

CORNUCOPIA COPPER CO. **OREGON.**

Letter returned unclaimed from former mine office, Quartzburg, via Baker City, Baker Co., Ore. Presumably dead.

CORNUCOPIA GOLD & COPPER MINING CO. **ARIZONA.**

Mine office: Cherry, Yavapai Co., Ariz. E. R. Hotzenpiller, president, and general manager. Idle for several years.

CORNWALL COPPER CO.

Office: 71 Broadway, New York.

CORNWALL MINES. **MISSOURI.**

Located in Ste. Genevieve county, Missouri, and were worked on a small scale, circa 1860. Ores are greater in variety than in quantity, those found including cuprite, melaconite, malachite, azurite, chalcocite, covellite, bornite, chalcopyrite, chalcanthite and chrysocolla. Idle many years.

COMPAÑIA CORO CORO DE BOLIVIA. **BOLIVIA.**

Mine office: Coro Coro, La Paz, Bolivia. Works native copper, occurring in beds of conglomerate, and is the largest Bolivian producr, making yearly about 1,500 tons of mineral averaging 85% fine copper. A little cuprite and chalcocite occur also, and silver, found with the copper in native form, as at the Lake Superior mines, is an important by-product. Has steam power and a small smelter, employing several hundred men. The Chilean government plans building a railroad from Arica to La Paz, with a branch to Coro Coro. This railroad, when built, must prove a great stimulus to Bolivian copper mining.

CORONA CONSOLIDATED GOLD & COPPER CO. **ARIZONA.**

Office: Union Blk., Prescott, Ariz. Geo. H. Schuerman, president and general manager; Eugene Newman, secretary; M. B. Hazeltine, treasurer. Organized April 9, 1903, under laws of Arizona, with capitalization $2,000,000, shares $1 par. Lands, 16 claims, area 320 acres, in the Turkey Creek district, showing 5 contact veins, between porphyry and schist, averaging 2′ to 6′ width, of which 3 are developed by 5 shallow shafts, deepest 80′, and by several tunnels, longest 520′, estimated to show 40,000 tons of carbonate and sulphide ores, with 6,000 tons blocked out for stoping, ore ranging 3% to 16% copper, 2 oz. to 12 oz. silver and $5.50 to $60 gold per ton. Idle since January, 1906, but hopes to raise funds for resumption.

CORONA COPPER CO. **WISCONSIN.**

Office: care of Frank A. Woodward, president, 512-60 State St., Boston, Mass. Is a reorganization of the Chippewa Copper Mining Co., with capitalization $3,000,000, shares $10 par. Lands, 1,600 acres, part owned in fee and part held under option, in Douglas county, Wisconsin, carrying the western extension of the Keweenawan copper belt. Has a 350′ two-compartment main shaft, with about 2,000′ of underground openings. Ores show average values of 0.74% to 3.5% copper. Estimates of ore reserves put out by the company are excessive.

CORONA GOLD & COPPER CO. **NEW MEXICO.**

Letter returned unclaimed from former mine office, Santa Rita, N. M.

CORONADO GOLD & COPPER MINING CO. **ARIZONA.**

Office: care of Chas. P. Myers, president and general manager, Prescott, Ariz. Lands, 14 claims, area 285 acres, including the Black Warrior group, in the Black Hills district of Yavapai county, Arizona, said to show considerable ore. Idle.

CORONADO MINING CO. **ARIZONA,**

Office: 52 Broadway, New York. Mine office: Metcalf, Graham, Co., Ariz. Wm. B. Thompson, president; J. W. Belches, vice-president; Wm. J. Palmer, secretary; Henry L. Westlake, general manager; John L. Scofield,

superintendent. Is controlled by the Shannon Copper Co., which owns 51% of the stock issue.

Lands, 23 claims, area 400 acres, adjoin the Detroit and Arizona mines, and carry what is supposed to be the extension of the famous Coronado vein. Development is by several short tunnels and shallow shafts, with a new 2-compartment working shaft on the Garnet claim, showing a good body of auriferous and argentiferous chalcopyrite, on the 200′ level. The Emerald mine shows a large body of sulphide ore that has given average assays of about 9% copper. Property is regarded as promising.

NUEVA COMPAÑIA MINERA DE CORPUS CHRISTI. **MEXICO.**

Mine office: Matehuala, San Luis Potosí, Mex. W. B. A. Dingwall, president and manager. Ores carry silver, lead, gold and copper. Principal development is by an 1,800′ tunnel.

SOCIEDAD DE MINAS y FUNDICIONES DE CORRALES. **ARGENTINA.**

Mine office: Chilecito, Rioja, Argentina. Has auriferous and argentiferous copper ores, with a 12-ton smelter, and gas power.

JOSÉ FRANCISCO CORREA. **CHILE.**

Office and mine: San Fernando, Colchagua, Chile. Has steam power and a small smelter with, a matting furnace. Employed circa 100 men, at last accounts.

CORTLAND GOLD & SILVER MINING CO. **COLORADO.**

Mine office: Ohio, Gunnison Co., Colo. Victor Reno, superintendent. Ores carry gold, silver, lead, copper and zinc. Has gasoline power.

CORUÑA COPPER CO., LTD. **SPAIN.**

Offices: Dashwood House, London, E. C., Eng. Mine office: Pino Arca, Coruña, Spain. R. F. A. Malabar, secretary. Organized April 19, 1901, with capitalization £1,000,000, shares £1 par; issued, £906,782. Lands, 3,040 acres, including the Santiago mines, bought for £900,000 in shares. Property was promoted by the notorious Ernest Terah Hooley. Ores occur in immense bodies, carrying about 2% copper, and are said to be refractory. Property was undergoing a little development work only, at last accounts.

CORY BROS. MINING CO. **MONTANA.**

Office: Helena, Deer Lodge Co., Mont. Lands, sundry claims on Beaver Creek, north of Helena, showing gold-copper ores.

COSTELLO COPPER CO. **ARIZONA.**

Office: care of Martin Costello, Tombstone, Ariz. Organized August, 1903.

COW CREEK COPPER MINING CO. **WYOMING.**

Address: care of Hiram C. Ridder, Denver, Colo. Location of property, presumably in Wyoming.

COXHEATH MINE. **NOVA SCOTIA.**

Owned by Cape Breton Copper Co., Ltd.

CRACKER JACK MINE. **ARIZONA.**

Mine office: Payson, Gila Co., Ariz. A. Lockwood, owner. Idle.

CREEDE COPPER MINING CO. **WYOMING.**

Mine office: Encampment, Carbon Co., Wyo. Has a contact vein between norite and schist.

CREPIN & RICHARDSON. **ARIZONA.**

Office and mine: Silver Bell, Pima Co., Ariz. Lands, sundry claims south of the Imperial mine and within 7 miles of the Arizona Southern railroad. The formation is quartzite and limestone, showing a contact vein carrying copper sulphides, with limestone gangue.

CRESCENT COPPER CO. **COLORADO.**

Office: Edinboro, Pa. Mine office: Boulder, Boulder Co., Colo. Organized under laws of Colorado, with capitalization $1,000,000, shares $1 par.

CRESCENT COPPER CO. **UTAH.**

Mine office: Park City, Summit Co., Utah. Idle.

CRESCENT COPPER CO. **WYOMING.**

Office and mine: Encampment, Carbon Co., Wyo. G. E. Heber, superintendent. Lands, circa 100 acres, 7 miles from Encampment, adjoining the Kurtz-Chatterton mine. Has an 800′ tunnel. Idle.

CRESCENT COPPER MINING CO. **ARIZONA.**

Office: care of Carl Clausen, president and general manager, Bisbee, Ariz. W. A. Eckerly, secretary. Organized 1903, under laws of Arizona, with capitalization $2,500,000, shares $2.50 par. Lands, 12 claims, in Tombstone Cañon, about 2 miles northwest of Bisbee, showing oxide and carbonate ores, and small quantities of chalcocite and iron ore, with quartz gangue, claimed to give average assays of 19.1% copper and 41 oz. silver per ton, from a vein said to range 8′ to 30′ in width. Idle.

MINA EL CRESTON DE COBRE. **MEXICO.**

Said to be owned by J. J. McCullom and J. L. Sheppard, to show rich oxide and carbonate ores, and to be located in La Dura district of Sonora, Mexico, but letter addressed to La Dura returned by postmaster, with notation that no such property exists in that district.

CRISTOBAL COPPER MINING CO. **NEW MEXICO.**

Is said to have an 8′ ore body, opened by a 100′ tunnel, on lands in the South Fork district, Taos county, New Mexico.

CROESUS GOLD & COPPER MINING CO. **IDAHO.**

Office: Beatrice, Neb. Mine office: Hailey, Blaine Co., Idaho. W. G. Page superintendent. Ores carry gold, silver and copper. Has steam power and a 10-stamp mill. Presumably idle.

CROFTON SMELTER. **BRITISH COLUMBIA.**

Owned by Britannia Smelting Co., Ltd.

CRONA COPPER CO. **COLORADO.**

Office: Clay Centre, Kan. Mine office: Lyons, Boulder Co., Colo. Chas. A. Southwick, president; C. W. Strong, secretary and treasurer. Organized, 1901, under laws of New Mexico, with capitalization $1,000,000, shares $1 par. Lands, 14 claims, 2 miles from Lyons.

CRONNEBANE MINES. **IRELAND.**

Owned by Ovoca Copper Syndicate, Ltd.

CROWL CREEK COPPER MINING CO. **AUSTRALIA.**

Mine office: Shuttleton, Nymagee district, New South Wales, Australia.

J. Booth, manager. Has steam power, concentrator, and a smelter with reverberatory furnaces, turning out blister copper. At close of 1905 a new vein, 14′ wide, with a 33″ paystreak averaging 12% copper, was cut on the 530′ level, and is to be developed. Production, 1905, is estimated at 1,000,000 lbs. fine copper.

CROWN LYELL, LTD. **TASMANIA.**

Dissolved, December, 1902. Described in Vol. V.

CROWN LYELL MINE. **TASMANIA.**

Mine office: Mt. Lyell, Montague Co., Tasmania. George Young, manager. Has a 719′ tunnel and 514′ shaft, latter showing some ore of medium grade. Suspended operations in latter part of 1905.

CROWN POINT MINING CO. **WASHINGTON.**

Office: care of Pioneer Investment & Trust Co., 709 Grant Bldg., Los Angeles, Cal. Lands, sundry claims in Chelan county, Washington, said to show ores of silver, copper and molybdenum. Presumably idle.

MINA LA CRUZ. **MEXICO.**

Office and mine: care of Ernesto Avila, owner Indé, Durango, Mexico. Was completing a 40-ton matting furnace, at close of 1905.

COMPAÑIA MINERA DE LA CRUZ. **MEXICO.**

Letter returned unclaimed from former mine office, La Cruz, Tamaulipas, Mexico.

CRYSTAL LAKE GOLD & COPPER MINING & SMELTING CO. **COLORADO.**

Office: 915 Barristers' Hall, Pemberton Sq., Boston, Mass. Philip G. Dawson, president; Kendric P. Crawford, treasurer and general manager; A. D. Wise, secretary. Capitalization $1,500,000, shares $1 par. Lands, 10 claims, 4 on Hotchkiss Mountain, south of Lake City, Hinsdale county, Colorado, and others in vicinity, showing ores of gold, silver, copper and lead.

CRYSTAL MINING CO. **WASHINGTON.**

Office: 45 Jamison Blk., Spokane, Wash. Letter returned unclaimed from former mine office, Bolster, Okanogan Co., Wash. Ores carry gold silver, lead and copper. Had steam power and a small smelter.

CRYSTAL MOUNTAIN MINING & DRAINAGE CO. **COLORADO.**

Mine office: Crystal, Gunnison Co., Colo. Geo. W. Melton, superintendent, at last accounts. Ores carry copper, gold and silver. Mine is opened by tunnel, and has steam power.

CUAHTEMOC MINING CO. **MEXICO.**

Office: care of J. Albert McKay, secretary, 508 Germania Bank Bldg., Pittsburg, Pa. Mine office: Ocotlán, Oaxaca, Mex. James McKay, president; Frank A. Vickery, treasurer; Guillermo W. Thompson, manager. Organized, 1904, under laws of West Virginia, with capitalization $400,000. Lands, 21 pertenencias, showing ore bodies carrying gold, silver, lead and copper. Presumably idle.

CUARTAS MINING CO. **MEXICO.**

Office: care of Harry McIntosh, Chicago, Ills. Mine office: Ayutla, Jalisco, Mexico. Harry McIntosh, president; Wm. H. Lees, vice-president

and general manager; Wm. T. Sheffield, secretary and treasurer. Capitalization, $100,000. Property is the old Cuartas mine, in the Bautista district, with sundry timber lands adjoining.

CUBA MINING CO. **UTAH.**

Mine office: Bingham Canyon, Salt Lake Co., Utah. Development is by tunnel, showing auriferous copper ores.

CUBAN EXPLORATION CO. **CUBA.**

Office: 11 Nassau St., New York. Letter returned unclaimed from former mine office, El Caney, Santiago, Cuba. W. A. Dennis, vice-president and general manager. At last accounts was reopening old and developing new copper properties, in the vicinity of Santiago de Cuba.

CUBAN LAND & DEVELOPMENT CO., LTD. **CUBA.**

Office: Dashwood House, London, E. C., Eng. Cuban office: Bahia Honda, Pinar del Rio, Cuba. W. R. Beit, agent. Organized Oct. 26, 1905, as successor to Cuban Mining & Development Co. Property is the Finca Nazareno, a plantation on which present company is centering its operations. Lands also include 2,766 acres of mineral territory in vicinity of Bahia Honda, and two gold claims in the province of Santa Clara. The copper mines have 5 old shafts, with workings of considerable extent, but in very bad condition. Company does not contemplate any mining operations in the near future.

CUBAN MINING & DEVELOPMENT CO., LTD. **CUBA.**

Reorganized as Cuban Land & Development Co., Ltd.

CUBAÑA CONSOLIDATED COPPER CO. **MEXICO.**

Office: care of R. M. Fitzgerald, 16-309 Montgomery St., San Francisco, Cal. Mine office: Arizpe, Sonora, Mex. Don Ray, president; A. H. Rose, vice-president; M. A. Nurse, secretary; Geo. H. McLean, superintendent. Organized January 6, 1903, under laws of Arizona, with capitalization $500,000, shares $1 par. Lands, 244 pertenencias, area 602 acres, bought for $20,000, showing 6 ore bodies, of 4′ to 20′ width, of which 3, carrying estimated average values of 12% copper, 10 oz. silver and $2 gold per ton, are opened by 6 shafts, deepest 102′, and by a number of tunnels, longest 250′ and 575′, with a total of 1,415′ of underground openings. Uses horse power. Mine is about 40 miles from La Cananea, the nearest railroad point, and is connected therewith by a good wagon road. Sample carloads of ore smelted gave returns of 23% copper, with fair gold and silver values. Property is considered of considerable promise.

CUCHARAS MINING CO. **MEXICO.**

Mine office: Acaponeta, Tepic, Mexico. J. M. Winston, manager. Operates the San Juan copper mine, opened by shaft and tunnel. Has steam power and a 40-ton smelter, employing about 50 men. Production, 1903, was 200,618 lbs. fine copper.

MINAS LA CUEVA y PEDRO ESTABAN. **MEXICO.**

Mine office: Mazapil, Zacatecas, Mexico. Owned by estate of J. S. Morrison. Manuel R. Orozco, manager. Produce copper as a by-product from silver-gold ores. Have steam power and a 25-ton smelter, employing about 100 men, at last accounts.

LA CUIVRE GROUP. **BRITISH COLUMBIA**

Office: care of E. A. Cleveland, owner, Vancouver, B. C. Located on Princess Royal Island, Skeena River Division, Cassiar District, B. C. Development is limited to tunneling. Idle.

MINA CULEBRA. **MEXICO.**

Mine office: Etzatlán, Jalisco, Mex. T. C. & H. K. Myers, owners. Is an antigua, developed by several hundred feet of shafts and tunnels, showing auriferous and argentiferous copper sulphides, in a vein of 1 to 3 metres width.

CULLIGAN MINE **WISCONSIN.**

A property in Douglas county, Wisconsin, which produced a little high-grade copper rock, (said to have come from a Michigan mine) in 1899. Idle.

CULLOWHEE COPPER CO. **NORTH CAROLINA.**

Reorganized, 1905, as Cullowhee Mining & Reduction Co.

CULLOWHEE MINING & REDUCTION CO. **NORTH CAROLINA.**

Office and mine: Cullowhee, Jackson Co., N. C. S. B. Ezell, president; D. D. Davies, vice-president; Thos. C. Cox, secretary. Organized 1905, as successor to Cullowhee Copper Co. Lands, 1,300 acres, including the old Cullowhee mine. Equipment includes steam and water power plants, hoists, Sullivan air-compressor and power drills. It is planned to install an electric plant to be run by water power. The mine shows a large body of high-grade sulphide ore, and is being developed on a large scale, with highly promising results. In fact the Cullowhee gives promise of making the first successful copper mine in North Carolina.

CUMARAL MINES & DEVELOPMENT CO. **ARIZONA.**

Letter returned unclaimed from former office, Oakland, Cal. Mine office: Old Glory, Pima Co., Ariz. Had auriferous and argentiferous copper ores, with gasoline power.

CUMBERLAND COPPER CO., LTD. **NEVADA.**

Office: 1033-141 Milk St., Boston, Mass. Capitalization $6,000,000. Company presumably is organized under laws of Maine. Is supposed to have property in White Pine county, Nevada, and very possibly is some relation of the Cumberland-Ely Copper Co.

CUMBERLAND-ELY COPPER CO. **NEVADA.**

Office: 71 Broadway, New York. Mine office: Ely, White Pine Co., Nev. Geo. Gunn, general manager. The private secretary of Daniel Guggenheim, of the American Smelting & Refining Company is president, and Messrs. Jas. Phillips, Jr., Barton Sewall and others are interested. Property presumably is controlled by the American Smelters Securities Co., which is supposed to own 51% of the stock. Capitalization $5,000,000, shares $1 par. Lands are sundry claims of large area, practically surrounding the holdings of the Nevada Consolidated Copper Co., and carrying a continuance of the immense ore body of that company. The mineralized zone is about one-half mile in width and of great length. Four 2-compartment shafts are being sunk on the Jupiter group, and very extensive developments are planned. The ore, while low in grade, is of vast extent, ore in sight having been estimated

as high as 25,000,000 tons. Management of the company is good, and the property is of great prospective value.

CUMBERLAND GROUP. **WYOMING.**

Mine office: Saratoga, Carbon, Co., Wyo. Lands are sundry claims on the southern slope of Coad Mountain, showing a 12′ ledge of quartzose material, conforming in dip and trend with the schists that form the country rock. A tunnel is being driven to cut this vein, at a depth of circa 1,000′.

CUPRITE COPPER CO. **ARIZONA.**

Dead. Succeeded by Golden Rule Copper Mining & Smelting Co., also dead, under scandalous circumstances.

CUPRITE COPPER CO. **ARIZONA.**

Office: Columbus, Ohio. Mine office: Clifton, Graham Co., Ariz. Employs 15 men. N. W. Lord, president; Isaac N. Stevens, vice-president; L. B. Kauffman, secretary; Geo. B. Kauffman, treasurer; F. C. Alsdorf, superintendent; Frank A. Ray, engineer; preceding officers and Frank B. Laine, directors. Organized March, 1904, under laws of Arizona, with capitalization $1,000,000, shares $1 par. Lands, 26 claims, area 490 acres, in the Copper Mountain district, opened by shafts of 30′ and 320′ and by tunnels of 150′ and 260′, showing ore bodies of 5′ to 100′ width. The work performed has been done in the leached zone, which carries isolated pockets of rich ore, from which sundry small shipments have given returns of 15% to 30% copper, and up to $5 gold per ton. Claims apparently are well located, and have a large ore body in the leached zone. Smelter shipments of 33 tons, 1905, gave average returns of 15% copper. Management plans sinking main shaft to the sulphide zone, and driving a tunnel to cut all the veins of the property, at depths of 1,000′ or more, as soon as the grade and character of the sulphide ores are proven by the main shaft. Company also owns about 2,000 linear feet of strong hematitic outcrops, ranging from 5′ to 100′ in width. It is likely that the copper veins, which are parallel with and similar to the Big Coronado vein of the Arizona Copper Co., are leached to very considerable depths, but prospects for developing large and profitable bodies of low and medium grade sulphides at depth are excellent. Company is well regarded, both as to management and lands.

CUPRITE MINING CO. **WYOMING.**

Mine office: Holmes, Albany Co., Wyo. Presumably idle.

CURLEW MINE. **MONTANA.**

Office: care of A. M. Holter, owner, Butte, Mont. Mine office: Victor, Ravalli Co., Mont. Thos. Cowan, superintendent. Mine was formerly a silver producer, and also shows zinc ores. A 12′ vein carrying 10% copper, also values in gold, silver and lead, was opened early in 1906.

CURTIN DAVIS PROPRIETARY CO. **TASMANIA.**

Offices: 39, Queen St., Melbourne, Australia, and Palmerston House, London, E. C., Eng. Mine office: Dundas, Tasmania. W. Knox, chairman; R. E. Tweddell, manager; E. Habben, secretary. Organized June 24, 1896, under No Liability act of Victoria, with capitalization £200,000, shares £1 par; issued, £182,229. Lands, 180 acres of argentiferous copper lands, with a developed mine, leased on tribute.

CUSHING y WALKUP. **MEXICO.**

Mine office: La Trinidad, Otaez, Durango, Mex. Emil Bruckhold, superintendent. Operate the Quien Sabe, Promontorio and other mines, employing about 200 men. Development is by tunnels. Mines have steam power and a 50-ton smelter with a single matting furnace. Production of copper is small, as copper is used merely as a carrier in making an iron-copper matte averaging 15% copper, 300 to 400 oz. silver and 12 oz. to 15 oz. gold per ton.

CYPRESS MINE. **ARIZONA.**

Letter returned unclaimed from former mine office, Bigbug, Ariz.

DACOTAH MINING CO. **MICHIGAN.**

Wound up, 1905, and lands sold for building lots.

DAIRA MINE. **JAPAN.**

Mine office: Fujikoto-mura, Yamamoto-gori, Ugo, Japan. Mine was opened, 1862, on numerous veins without fixed strike or dip, and frequently crossing, in andesite country rock. Ores are galena, chalcopyrite, sphalerite and iron pyrites. Product is chiefly silver and lead, with a very small amount of copper as a by-product.

DAKOTA CALUMET COMPANY. **SOUTH DAKOTA.**

Office: Lima, Ohio. Mine office: Sheridan, Pennington Co., S. D. Samuel A. Baker, vice-president; Wm. J. Booth, secretary; H. C. Ellison, treasurer. Organized 1902, under laws of South Dakota, with capitalization $3,000,000, shares $1 par. Is controlled, through stock ownership, by the Continental Copper Co. Lands, 19 patented claims, including the Lilian group, area 179 acres, also a 27-acre millsite, with total landed holdings of 319 acres. Has shafts of 40′, 80′ and 100′ and a tunnel of 380′, giving total underground openings of 600′, on the strength of which a 150-ton smelter was built. Has a 40-h. p. hoist, good for depth of 1,000′, a 10-drill Sullivan air-compressor and 5 power drills. Buildings include a carpenter shop, smithy, laboratory and three dwellings. The smelter, ¼ mile from the mine, and several hundred feet lower, of wood on stone foundations, is connected with the mine by a Bleichert aerial tram and has a 150-ton Colorado Iron Works blast-furnace, with 120-h. p. steam plant, and was planned to turn out pimple copper of 80% tenor. Idle for several years, and company apparently exhausted financially.

DALANE SOELV-OG-KOBBERGRUBER. **NORWAY.**

Mine office: Brunkeberg Sogn, Norway. Is a small producer of silver and copper, when operated, which is irregularly.

DALKEY MINE. **AUSTRALIA.**

Office: Port Adelaide, South Australia. J. Johnson, manager.

DALTON & LARK MINING & MILLING CO. **UTAH.**

Controlled by Bingham Consolidated Mining & Smelting Co.

DALY COPPER MINING CO. **AUSTRALIA.**

Mine office: Leighs Creek, South Australia. F. Sutherland, manager. Has steam power, and employed about 20 men, at last accounts.

DALY JUDGE MINING CO. **UTAH.**

Office: Salt Lake City, Utah. Mine office: Park City, Summit Co., Utah. John Daly, president; O. J. Salisbury, general manager; John McSorley, superin-

tendent. Organized 1901, under laws of Utah. Has authorized a bond issue of $300,000, at 7%. Lands, 146 claims, area 715 acres, including the Anchor mine, with three ore bodies, known as the South, Contact and North veins, the middle or contact vein being the principal and showing a well defined and persistent outcrop, traced 3,000′. Property also includes the Bonanza group, regarded as valuable but lacking development. Ore values are mainly in silver and lead, with a little copper as a by-product. The 6,000′ Anchor tunnel, for operating and drainage purposes, is connected with the 1,200′ level of the 1,650′ three-compartment Anchor shaft, which has a powerful hoist operating double-deck cages. The Anchor workings are said to have about 200,000 tons of ore blocked out for stoping. The mine has about 8 miles of underground openings, and makes 300 to 450 gallons of water per minute, this being sufficient for the use of the concentrator, and water is supplied, under contract, to the Daly West. There also is a lake, two miles from the mine, affording an alternative water supply. The concentrator has a capacity of about 300 tons daily, and the Sherman slimes process has proven highly satisfactory, reducing the crude ore about 6 into 1, concentrates having a net value of approximately $35 per ton. Property is considered good, and management stands well locally, but is entirely too secretive about the work done and results secured.

DALY MINING CO. **MONTANA.**

Office: care of Marcus Daly Estate, Butte, Mont. Letter returned unclaimed from former mine office, Copperopolis, Meagher Co., Mont. Organized 1903, under laws of Arizona, with capitalization $1,000,000, to take over sundry mining properties of the Marcus Daly estate, in Meagher, Silver Bow and Lewis & Clark counties, Montana Properties in Meagher county are the Copperopolis, Daly, North Pacific, Darling Fraction and others. The Copperoplis mines have 3 shafts, deepest 500′, with a good surface equipment, and were small producers of high-grade ore for many years, but have been idle since 1903.

DALY WEST MINING CO. **UTAH.**

Office: 163 South Main St., Salt Lake City, Utah. Mine office: Park City, Summit Co., Utah. Employs about 500 men. J. Ernest Bamberger, president; W. Dixon, vice-president; W. S. McCornick, treasurer; preceding officers, F. J. Hagenbarth and Lazard Kahn, directors; J. Barnett, secretary; Ernest Bamberger , general manager; J. A. McCaskell, general superintendent; F. W. Sherman, mill superintendent; Corporation Trust Co., of New York, First National Bank of Boston and McCornick & Co. of Salt Lake City, registrars; McCornick & Co., of Salt Lake City, American Loan & Trust Co., of Boston, and North American Trust Co., of New York, transfer agents. Organized Feb. 14, 1902, under laws of Colorado, with capitalization $3,600,000, shares $20 par. Paid dividends of $1,332,000 in 1903; $1,044,000 in 1904, and $432,000 in 1905, with total dividend disbursements, to end of 1905, of $5,067,000. Ended 1905 with a cash balance of $411,886.15.

Lands, 50 patented claims, area 250 acres, in the Uintah district, showing extensive ore bodies carrying argentiferous and auriferous chalcopyrite, galena and sphalerite, with a silicious gangue. Ore production is about equally divided between smelting and concentrating grades. The mine has three

principal veins, of 4′ to 6′ minimum width and up to 40′ maximum width. Mine has an extreme depth of 1,700′ and has upwards of 10 miles of workings. Much exploratory and development work was done during 1905, with encouraging results, and new ore bodies are being developed. The Ontario drain tunnel No. 2 is being extended into the Daly West property, at the expense of the Daly West company, which pays therefor a monthly rental of $750. This tunnel will unwater the lower levels, about 600′ below the present openings.

The concentrator, of 350 tons daily capacity, is equipped with crushers, rolls, two 5′ Huntington mills, Wilfley tables, and an automatic ore-sorting belt. The practice of this concentrator, under the management of Mr. Sherman, is exceptionally advanced, and results secured on complex ores are not exceeded in any American reduction plant, the saving being 98% in lead and 70.5% in silver, with six tons put into one. The tailings mill, 56x82′ in size, stands about 400′ northeast of the concentrator, and has a 5′ Huntington mill for regrinding, 7 slime, settling and classifying tanks, 2 two-compartment jigs, 6 concentrating tables and 1 Wilfley table. This mill was planned to treat the enormous tailings dump of the property, at a cost of 15 cents to 20 cents per ton, with a net profit of 25 cents to 50 cents per ton, at the rate of 200 to 250 tons daily. An ample water supply for both mills is secured, under contract, from the Daly Judge mine.

Production has shown a considerable decrease during each of the two past years, and receipts were only $1,237,139.60 in 1905. The large reserves of high-grade ore were much impaired, by undue crowding for several years, and hopes for the future must be placed mainly on the large bodies of low-grade milling ore, and on the development of new high-grade ore bodies. The mine has about three years' supply of concentrating ore blocked out, with further large quantities available for future development. Production, 1905, was 1,225,731 lbs. fine copper, 16,712,978 lbs. lead, 9,026,517 lbs. zinc, 1,798,628 oz. silver and 1,397 oz. gold. Confidence in the mine and its management has been impaired by the mistaken policy, followed for several years, of pushing the mine nearly to the point of exhaustion. For the past two years the mine has been managed along sounder lines, and with a keener eye to the future welfare of the property. Developments are of a favorable nature, and the future of the property seems brighter than since 1903.

DAMARALAND COPPER SYNDICATE, LTD. — **GERMAN SOUTHWEST AFRICA.**

Voluntarily liquidated, Febuary, 1903.

DANA COPPER CO. — **MICHIGAN.**

Office: 68 Devonshire St., Boston, Mass. F. H. Raymond, president; C. O. Burbank, secretary and treasurer; preceding officers, John C. Watson and J. H. Chandler, directors. Lands, 640 acres, being the East ½ of Section 24 and East ½ of Section 25, in Town 58 North, Range 31 West. Property is bounded on the north by the Arnold, and on the other three sides by the Central. Was never a producer, and idle for many years.

DANES LEA MINING CO. — **CALIFORNIA.**

Office: care of W C. Harland, president, San Diego, Cal. Mine office:

Encinitas, San Diego Co., Cal. W. H. McKinnon, manager. Lands, 20 claims, 8 miles east of Encinitas, with shafts of 100′ and 280′, also a tunnel. Has a 3′ vein of medium-grade chalcopyrite, traversing porphyry. Has gasoline power. Presumably idle.

DANVILLE & VIRGINIA COPPER MINING CO. **VIRGINIA.**

Merged, 1903, in Carolina King Mining Co.

DARGIN & RICHARDSON. **MEXICO.**

Office and mine: Unión de Tula, Jalisco, Mex. Lands, 60 pertenencias, 7 miles southwest of Ayutla, showing a fissure vein of 5′ to 10′ width, in diorite, carrying argentiferous oxides and carbonates, associated with hematite. Has a 130′ shaft and 325′ tunnel, with some ore blocked out for stoping.

DARNELL MINING & MILLING CO. **WASHINGTON.**

Mine office: Kalama, Cowlitz Co., Wash. H. M. Stevens, superintendent, at last accounts. Ores carry gold, silver and copper. Has steam power, concentrator and 50-ton cyanide plant.

DARTMOOR MINERALS, LTD. **ENGLAND.**

Offices: 28, Victoria St., London, S. W., Eng. R. F. Eden, secretary Organized July 21, 1905, with capitalization £15,000, shares £1 par, in 8,000 ordinary £1 shares and 40,000 deferred 1s. shares.

DAULTON COPPER CO. **CALIFORNIA.**

Letter returned unclaimed from former mine office, Daulton, Cal.

DAVENPORT MINE. **WASHINGTON.**

A prospect, near the head of Horseshoe Basin, Washington. A ton of ore shipped to smelter gave returns of $69, in lead, copper, silver and gold.

DAVID HARUM COPPER CO. **TEXAS.**

Office: 30 Broad St., New York. Moribund.

ERZBERGWERK DAVID VEREINIGUNG. **GERMANY.**

Office: Köln, Westfalen, Germany. Carl Hobert, Jr., president. Has lead-copper ores, opened by one pit and one shaft.

DAVIS MINING & SMELTING CO. **CALIFORNIA.**

Out of business and presumably dead.

DAWES RANGE COPPER & GOLD MINING CO. OF QUEENSLAND. (NO LIABILITY.) **AUSTRALIA.**

Offices: 78, Queen St., Melbourne, Australia, and 76, Bishopsgate St., E. C., Eng. Hon. Henry Foster, J. P., chairman; John Brown, manager; Stobbs & Roscoe, British agents. Organized January, 1900, under laws of Victoria, with capitalization £300,000, shares £1 par; issued, £250,000. Lands, 240 acres, in the Gladstone district of Queensland. Idle, owing to lack of funds.

DAY DREAM & BRETONARTE COPPER MINING CO. **AUSTRALIA.**

Mine office: Leighs Creek, South Australia. F. M. Montague, manager. Has steam power and employed about 50 men, at last accounts.

DEADWOOD GOLD & COPPER MINES CO. **SOUTH DAKOTA.**

Letter returned unclaimed from former mine office, Deadwood, S. D.

JULIA DEANE MINING CO. **UTAH.**

Mine office: Bingham Canyon, Salt Lake Co., Utah. David Clay, manager. Has a tunnel showing gold-copper ores. Has steam power. Idle.

'S COPPER REFINING CO. NEW JERSEY.

nd works: Chrome, Middlesex Co., N. J. E. G. Hothorn, presi-gelstein, vice-president; A. F. Holden, managing director; F. W. treasurer; F. O. Dettman secretary; H. A. Prosser, general man-nized 1903, under laws of New Jersey, with capitalization

Is owned jointly by the United States Mining, Smelting, Re-ning Co. and the metal brokerage house of Aron Hirsch & Sohn, , Germany.

npany has a plant at Chrome, N. J., for copper, and a lead plant , Ind. The Chrome works comprise an electrolytic copper re-monthly capacity of 6,000 tons, and a complete smelting and plant for the treatment of ores, concentrates, mattes and bullion, rected in the spring of 1906. Copper supplies are received mainly Montana, Arizona, California and British Columbia, with odd lots rom other fields. The copper is received in slabs or cakes, and anode plates of 350 lbs. to 400 lbs. weight, by a Walker casting th 22 molds. The plant has two 75-ton reverberatory fur-remelting blister copper, and two furnaces for remelting cathode e plant includes a circular blast-furnace, 42" at the tuyeres and sing blast under pressure of 11 oz. per square inch.

are transferred in sets of 15 from the casting machine to the tanks, by electric traveling cranes. The electrolytic plant has orming two systems of 12 compartments, with 34 baths each, a system. Tanks are lead-lined, 3' 6" broad, 3' deep and 10' long, ontaining 15 anodes and 16 cathodes, the extra cathode provid-l plates. Cells are arranged in steps, in two rows, with a 12" en tanks. Current is conveyed to the cells by copper leads of

Current density is 15 to 17 amperes per square foot, and the f potential of bath is 0.3 volts. The cell bath temperature is 52° Bath contains 40 grams of copper and 140 cc. sulphuric acid per blister copper treated contains antimony, arsenic, selenium and s well as copper, nickel, gold and silver, and the sludge from the ated by filter presses and refined in a cupel furnace for gold and s. As much silver is volatilized in refining, the gases from the sucked off by a fan, then cooled and filtered through flannel e entering the stacks. From the waste electrolyte liquor, crude ate and copper sulphate are made, there being, in connection inery, a sulphate plant where bluestone is produced for the re-of the works. Waste gases from the reverberatory furnace are er a Babcock-Wilcox boiler. The power plant includes steam-nos of 1,000-h. p. and 1,200-h. p., giving 5,500 amperes at 115 6,500 amperes at 130 volts, respectively.

al plant, located at Grasselli, Indiana, a suburb of Chicago, has capacity of 2,000 tons, and is the first electrolytic lead refinery d States. The plant and metallurgical processes of the De Lamar trictly modern, and the practice is excellent.

DECATUR COPPER MINING CO. **ARIZONA.**

Office: 503 North Main St., Decatur, Ills. Mine office: Jerome, Yavapai Co., Ariz. W. J. Wayne, president; Frank P. Wells, vice-president and treasurer; Geo. R. Bacon, secretary; W. S. Owens, superintendent. Organized 1897, under laws of Arizona, with capitalization $2,000,000, shares $1 par. Lands, 10 claims, area 180 acres, also a 10-acre millsite, 10-acre smelter-site and sundry other lands, in the Verde district, showing 10 fissure veins and lenses, of which 4 are being developed, these having an average width of 4′ and giving average assays of 5% to 8% copper, 20 oz. silver and $10 gold per ton. Has oxide and carbonate ores near surface, with sulphides below 60′ depth, opened by 6 shafts, deepest, 280′, and by tunnels of 70′ and 150′. Also has a free-milling gold vein, in the Mineral Point district. Has gasoline power. Officers are men of good standing and property is considered promising, but company is suffering from the common trouble of lack of funds, and operations are on a very restricted scale.

DEDHAM COPPER MINING CO. **WISCONSIN.**

Office: West Superior, Wis. Abram G. Ross, president; Wm. C. Burke, secretary. Organized November, 1902, under laws of Wisconsin, with capitalization $1,300,000, shares $25 par; debentures, $150,000 authorized at 6%. Lands, 320 acres, also a 12-acre millsite, with waterfall estimated at 2,400 h. p. available. Has steam power and air-compressor. Property was tested by 34 pits, and a shallow shaft, showing 3 cupriferous amygdaloid beds, each claimed to average 90′ width and to be about one-third mineralized. Idle.

DEEMS MINING CO. **UTAH.**

Office: Salt Lake City, Utah. Letter returned unclaimed from former mine office, Bingham Canyon, Salt Lake Co., Utah. C. D. Rooklidge, president; Abram Hanauer, Jr., secretary and treasurer. Organized 1904, with capitalization $75,000, shares 25 cents par.

DEEP RIVER GOLD MINING CO. **NORTH CAROLINA.**

Mine office: High Point, Guilford Co., N. C. W. G. Gaither, manager. Property is an old and idle mine, carrying gold-silver-copper ores.

DEER CREEK DEVELOPMENT CO. **UTAH.**

Mine office: American Fork, Utah Co., Utah. John Cleghorn, president; Henry Johnson, secretary. Organized 1903, with capitalization $125,000, shares 25c. par. Land, 7 claims, in the Deer Creek division of the American Fork mining district, showing a 3′ to 6′ fissure vein in granite, ore therefrom giving asays of 22% copper and 7 oz. silver per ton.

DEER CREEK GOLD & COPPER MINING CO. **WASHINGTON.**

Letter returned unclaimed from former mine office, Silverton, Snohomish Co., Wash. Had a tunnel, showing considerable low-grade ore.

SOCIEDAD MINERA DEFENSO y TODOS SANTOS. **CHILE.**

Mine office: Taltal, Antofagasta, Chile. Daniel Olivia, superintendent. Has auriferous copper ores and employed about 40 men, at last accounts.

DE LAMAR-WALL MINING & MILLING CO.

Dead. Lands sold, 1903, to Utah Copper Co.

DE LAMAR'S COPPER REFINING CO. NEW JERSEY.

Office and works: Chrome, Middlesex Co., N. J. E. G. Hothorn, president; L. Vogelstein, vice-president; A. F. Holden, managing director; F. W. Batchelder, treasurer; F. O. Dettman secretary; H. A. Prosser, general manager. Organized 1903, under laws of New Jersey, with capitalization $3,100,000. Is owned jointly by the United States Mining, Smelting, Refining & Mining Co. and the metal brokerage house of Aron Hirsch & Sohn, Halberstadt, Germany.

The company has a plant at Chrome, N. J., for copper, and a lead plant at Grasselli, Ind. The Chrome works comprise an electrolytic copper refinery, with monthly capacity of 6,000 tons, and a complete smelting and converting plant for the treatment of ores, concentrates, mattes and bullion, was being erected in the spring of 1906. Copper supplies are received mainly from Utah, Montana, Arizona, California and British Columbia, with odd lots picked up from other fields. The copper is received in slabs or cakes, and is cast into anode plates of 350 lbs. to 400 lbs. weight, by a Walker casting machine with 22 molds. The plant has two 75-ton reverberatory furnaces, for remelting blister copper, and two furnaces for remelting cathode copper. The plant includes a circular blast-furnace, 42″ at the tuyeres and 13′ high, using blast under pressure of 11 oz. per square inch.

Anodes are transferred in sets of 15 from the casting machine to the electrolytic tanks, by electric traveling cranes. The electrolytic plant has 816 cells, forming two systems of 12 compartments, with 34 baths each, 408 cells in a system. Tanks are lead-lined, 3′ 6″ broad, 3′ deep and 10′ long, each bath containing 15 anodes and 16 cathodes, the extra cathode providing terminal plates. Cells are arranged in steps, in two rows, with a 12″ drop between tanks. Current is conveyed to the cells by copper leads of 1½ x 4¾″. Current density is 15 to 17 amperes per square foot, and the difference of potential of bath is 0.3 volts. The cell bath temperature is 52° to 57° C. Bath contains 40 grams of copper and 140 cc. sulphuric acid per liter. The blister copper treated contains antimony, arsenic, selenium and tellurium, as well as copper, nickel, gold and silver, and the sludge from the tanks is treated by filter presses and refined in a cupel furnace for gold and silver values. As much silver is volatilized in refining, the gases from the furnace are sucked off by a fan, then cooled and filtered through flannel sacks, before entering the stacks. From the waste electrolyte liquor, crude nickel sulphate and copper sulphate are made, there being, in connection with the refinery, a sulphate plant where bluestone is produced for the requirements of the works. Waste gases from the reverberatory furnace are burned under a Babcock-Wilcox boiler. The power plant includes steam-driven dynamos of 1,000-h. p. and 1,200-h. p., giving 5,500 amperes at 115 volts, and 6,500 amperes at 130 volts, respectively.

The lead plant, located at Grasselli, Indiana, a suburb of Chicago, has a monthly capacity of 2,000 tons, and is the first electrolytic lead refinery in the United States. The plant and metallurgical processes of the De Lamar works are strictly modern, and the practice is excellent.

DELAWARE MINE. **MICHIGAN.**

A property in Keweenaw county, Michigan, on which sums aggregating about $3,300,000 were sunk by successive managements. Now owned by Calumet & Hecla Mining Co., and described under title of Manitou. Old operations very fully described in Vol. II.

DEL COBRE CONSOLIDATED MINING CO. **ARIZONA.**

Mine office: Florence, Pinal Co., Ariz. Organized under laws of Delaware. Lands, 15 claims, 12 miles east of Florence, held under bond and lease, opened by a 200′ shaft, showing ores carrying gold, silver and copper.

MINA DELFINA. **MEXICO.**

Office: Centro Mercantil No. 3, Mexico, D. F. Mine office: Chilpancingo, Guerrero, Mexico. Paul Merienne, mine manager. Ores carry silver, gold and copper values. Has steam power and a 5-stamp mill.

DEL MONTE MINES. **ARIZONA.**

Office: care of M. F. Donovan, owner, Tucson, Ariz. Lands, 7 claims, 35 miles from Tucson, on the southeastern slope of the Santa Catalina Mountains, with about 700′ of shafts and tunnels, developing a vein of 80′ to 100′ width, from which it is claimed that 10,000 tons of ore, carrying 15% copper and $4 gold per ton, have been placed on the dump. Operations are hampered by lack of rail facilities, which are hoped to be secured by the construction of the Phoenix & Eastern railway.

DEL NORTE COPPER CO. **ARIZONA.**

Office: care of Ellery R. Bassett, New Bedford, Mass. Lost lands, near Kirtland, Yavapai county, Arizona.

DEL NORTE COPPER CO. **CALIFORNIA.**

Letter returned unclaimed from former mine office, Smith River, Del Norte Co., California.

DEL ROY COPPER MINING & SMELTING CO. **NEW MEXICO.**

Office: El Paso, Texas. Mine office: Alamogordo, Socorro Co., N. M. Employs 25 men. Wm. Moeller, president; W. J. Harris, vice-president; H. F. Kettler, secretary and treasurer; M. D. Gaylord, general manager; Geo. Munroe, mine superintendent. Organized April 6, 1906, under laws of New Mexico, with capitalization $2,500,000, shares $2.50 par. Lands, 57 claims, area 1,157 acres, also a 60-acre millsite, 300 acres timber lands and 160 acres placer claims, in the San Andreas district, showing 23 fissure and contact veins, in a formation of granite-porphyry and schist, overlaid by a lime capping. Work has been done on 11 veins, ranging 3′ to 150′ in width, mine having 1,975′ of underground openings, estimated to show 50,000 tons of ore, with 32,000 tons blocked out for stoping, averaging 8% copper, 5 oz. silver and $1 to $5 gold per ton. Properties include several extensive antiguas. Company hopes to secure railroad transportation by a narrow-gauge line, reaching within 6 miles of the mines, and plans developing extensively and installing a power plant, 100-ton concentrator and small matting furnace.

DEMOCRATA CANANEA SONORA COPPER CO. **MEXICO.**

Office: 1006 Commercial Tribune Bldg., Cincinnati, Ohio. Mine office: La Cananea, Sonora, Mex. Employs 40 men. H. H. Hoffman, president;

C. E. Hoffman, vice-president; Wm. H. Simpson, treasurer; Leo. G. Cloud, secretary; Peter F. Hook, superintendent. Organized 1905, under laws of Arizona, with capitalization $3,000,000, shares $10 par, issued, $2,000,000.

Lands, 18 pertenencias, lying in the heart of the Greene Consolidated property, between the Cobre Grande and Veta Grande mines of the latter. Development is by a 450′ shaft and 500′ tunnel, with about two miles of underground openings, estimated to place in sight 350,000 tons of ore carrying 6% copper and about $3 gold and silver per ton. Has a 125-ton concentrator and 125-ton smelter, and plans building a new 300-ton smelter with modern equipment. Production, 1903, was 3,747,820 lbs. fine copper, since which year production has been suspended, but is to be resumed shortly.

DEMOCRATA MINING CO. **MEXICO.**

Succeeded, 1905, by Democrata Cananea Sonora Copper Co.

DENN-ARIZONA DEVELOPMENT CO. **ARIZONA.**

Office: 600 First National Bank Bldg., Duluth, Minn. Mine office: Bisbee, Cochise Co., Ariz. Employs 50 men. Martin Pattison, president; Thos. Bardon, vice-president; L. C. Shattuck, treasurer; Byron M. Pattison, superintendent; preceding officers, Archibald Mark Chisholm, A. Guthrie and Maurice Denn, directors; John G. Williams, secretary; Jos. Collie, mine superintendent. Organized 1905, under laws of Arizona, with capitalization $750,000, shares $10 par.

Lands, 13 claims, area circa 200 acres, partly owned in fee, and partly held under bond and lease, lying immediately north of the Junction. Three claims, under option from John M. Johnson, have been surrendered. Main shaft, 980′. The conglomerate capping was penetrated and limestone reached at 810′, and it is planned to begin drifting and crosscutting in four directions, at a depth of 1,000′. It is expected that the shaft will prove wet and a pump station, to be cut on the 1,000′ level, will have two triple-expansion pumps, each of 1,000 gallons capacity per minute, working against a 1,000′ head. There also will be three 800-gallon sinking pumps. The main shaft has a first-motion Ottumwa Corliss hoist, raising double-deck cages, and an air-compressor. A second shaft was started May 8, 1906, on the Lee claim. This has a temporary hoist and 6-drill Sullivan air-compressor. Mine has 6 buildings. Considerable diamond drilling has been done, and ores averaging 12% copper were secured from a 30′ core of disseminated cuprite, found at a depth of 950′. Management is experienced and capable, and property is one of much promise.

DENORO MINES, LTD. **BRITISH COLUMBIA.**

Office: Rossland, B. C. Mine office: Eholt, Yale district, B. C. Ross Thompson, president; Dr. J. A. L. McAlpine, vice-president; Smith Curtis, secretary, treasurer, and managing director; S. L. Graham, mine superintendent. Organized 1903, under laws of British Columbia, as successor of the King Mining Co., Ltd., with capitalization $1,500,000, shares $1 par. Lands, 4 claims, area circa 190 acres, adjoining the British Columbia mine, in the Boundary district. Property shows 3 ore bodies, of 20′ to 100′ width, carrying auriferous and argentiferous chalcopyrite, with iron pyrites and

lime gangue. Owing to the excess of iron and lime, the smelters pay a premium for fluxing use, actual smelting cost, 1903, being only 16 cents per ton, to the Denoro company. Mine has a 190′ shaft, but principal development is by 3 tunnels. Production, 1904, was 529,930 pounds fine copper, 4,657 oz. silver and 684 oz. gold. Ore production, in February, 1906, was at the rate of 100 tons daily, and it was then planned to increase shipments to 200 tons daily, in a short time. Property is considered decidedly promising. Was bought, June, 1906, by British Columbia Copper Co., Ltd.

DENVER COPPER MINING & LEASING CO. **COLORADO.**

Mine office: Morrison, Jefferson Co., Colo. Everett B. Curtis, secretary and treasurer. Idle for some years.

DENVER GROUP GOLD & COPPER CO. **ARIZONA.**

Office: 319 Douglass Bldg., Los Angeles, Cal. Mine office: Wickenburg, Maricopa Co., Ariz. Thos. S. Wadsworth, president. Capitalization $2,000,000, shares $1 par. Lands, 10 patented claims, area 194 acres, 12 miles northeast of Wickenburg Mineral formation traced 6,000′, with 80 to 300′ width of vein matter, showing scattered parallel veins and stringers. Has tunnels of 225′ and 600′, also 5 prospecting shafts. Ore is sulphide, carrying a little native copper, assaying up to 15% copper and $10 gold per ton. Property considered promising, but idle for several years.

DENVER MINE **ARIZONA.**

Mine office: Gilbert, Yavapai Co., Ariz. John Witherally, owner. Has gold-copper ores. Idle at last accounts.

DERBY SYNDICATE, LTD. **AUSTRALIA.**

Voluntarily liquidated, July, 1902.

DEROFFSKI MINE. **SIBERIA.**

A small copper producer, near Semipalatinsk, Siberia.

COMPAÑIA MINERA y FUNDIDORA DESCUBRIDORA. **MEXICO.**

Mexican title of Descubridora Mining & Smelting Co.

DESCUBRIDORA MINING & SMELTING CO. **MEXICO.**

Office: 17 Battery Place, New York. Mine offices: Mapimí, Durango, Mexico, and Conejos, Sinaloa, Mexico. R. Brendel, general manager. Principal property is the Descubridora group, at Mapimí, opened by a 500′ shaft, showing very large quantities of very low-grade basic silver-copper carbonate ore, requiring silicious ores for fluxing, latter bought in the market, as not produced by the company's mines. The Mapimí property has a complete steam and electric power equipment, and had a 600-ton smelter, built 1902, but a portion of this smelter has been sold to the Continental Copper Co. Property was leased by the Guggenheim Exploration Co., which was succeeded by the American Smelters Securities Co. Mapimí property idle since 1903. Property at Conejos includes several mines and a 200-ton smelter, idle since 1904. Production, 1903, was 4,964,272 lbs. fine copper.

DESERT QUEEN MINE. **ARIZONA.**

Mine office: Quartzite, Yuma Co., Ariz. Lands, 11 claims, in 2 groups, opened by crosscut tunnels, cutting veins at 300′ to 500′ depth, with 600′ of drifting on the ore bodies. Has a 40-h. p. gasoline engine, air-compressor

and power drills. Has been under development since circa 1902. Ores have given smelter returns of 10% copper, 25 oz. silver and $12 gold per ton.

DESPATCH COPPER-GOLD MINING CO. **COLORADO.**

Office: care of R. A. Gurley, secretary and treasurer, Denver, Colo. Mine office: Morrison, Jefferson Co., Colo. Henry Appel, president; O. M. Deemer, managing director; Geo. Q. Adams, vice-president and superintendent. Lands, 8 patented claims, adjoining the F. M. & D. property, opened by shafts, showing stringers of ore assaying 9% to 14% copper. Has steam power and plans continuing development.

DE SOTO MINING CO. **ARIZONA.**

Office: 71 Broadway, New York. Mine office: Middelton, Yavapai Co., Ariz. J. L. Elliot, president; Cyrus Robinson, vice-president; Benj. Prince, secretary; preceding officers, C. E. Finney, Francis Risk, LeRoy T. Harkness, and Albert Kerr, directors; R. T. Mason, superintendent; Pope Yeatman, engineer. Organized January, 1905, under laws of New Jersey, with capitalization $100,000, shares $100 par. Bonds, $1,000,000 authorized, at 6%; issued, $500,000.

Lands, 82 claims, area 1,400 acres, in the Bradshaw Mountains, about 40 miles southeast of Prescott, covering about 6½ miles of the strike of a very persistent copper formation. Lands, formerly held by Bradshaw Mountain Copper Mining & Smelting Co., lie about midway between Crown King and Mayer. Country rocks are porphyry and quartzite, showing five parallel veins of 10′ to 60′ width, carrying cuprite, melaconite, chalcocite, bornite, malachite, azurite and chalcopyrite, with schistose gangue, said to average $12 to $15 per ton in copper, gold and silver values.

Development is by the 800′ Copper Link tunnel and the 2,400′ Hot Number tunnel, latter 400′ vertically lower than former, cutting the ore body 1,374′ below the crest of the mountain, and having a double tram-track, laid with 20-lb. steel rails. Mine has about 8,000′ of underground workings, exposing a large amount of ore of medium grade. A 4,000′ Bleichert aerial tramway, of 2,000 tons daily capacity, connects the mouth of the Hot Number tunnel with 2,000-ton ore bins at the railway station. Mine plant includes two 80-h. p. boilers, a 24 drill Ingersoll-Sergeant air-compressor, power drills and 9 miles of air and water-pipe lines.

The concentrator, of steel construction, is 160x200′, equipped with 2 Blake crushers, 2 centrifugal crushers, 4 sets of rolls, 2 Hancock jigs, 16 Overstrom tables, 16 vanners and 8 sizers. Company has largely the same officers as the Arizona Smelting Co., which owns the new Humboldt smelter, and the mine is operated in close connection with the smelter.

DETROIT COPPER MINING CO. OF ARIZONA. **ARIZONA.**

Office: 99 John St., New York. Mine office: Morenci, Graham Co., Ariz. Employs about 1,000 men. James Douglas, president; Cleveland H. Dodge, vice-president; Geo. Notman, secretary and treasurer; Chas. E. Mills, general superintendent; Dr. L. D. Ricketts, consulting engineer; H. H. McLean, mine superintendent; G. E. Hunt, mill superintendent; H. S. Van Gorder, superintendent supply and mercantile department; J. B. Fleming,

mechanical engineer. Organized under laws of Michigan, with capitalization $1,000,000, shares $25 par. Mine was opened circa 1880 and has become a very large producer. Lands are extensive, including the Ryerson, Arizona, Central, Copper Mountain, Yankee, West Yankee, Montezuma and Santa Rosa mines, at and near Morenci, opened by tunnels and shafts, deepest workings being about 400′ below the surface. Originally mines were worked open-cast, as the ore bodies are of immense size, though low in grade, averaging, 3% to 4% copper, with only traces of gold and silver. Ores are chiefly sulphide, and highly silicious, with gangue carrying up to 40% alumina, requiring very careful handling. Much the larger part of the production is concentrating ore, which is about one-half oxides and carbonates, and one-half sulphides. A 240′ ore-bin, at the Ryerson, is connected with the mill by belt conveyor. The Santa Rosa mine, bought circa 1905, is to be developed extensively, and an electric transmission line has been built thereto, and a good mining plant installed.

Gas power is used extensively throughout the mine, mill and smelter, except for hoists and locomotives. A Loomis generator, with capacity to supply gas for developing 1,000 h. p., consumes New Mexico bituminous coal, giving an efficiency of about one horse-power-hour from 1.5 lbs. to 1.75 lbs. coal per hour, effecting a saving of about 30% in fuel costs. The power-house, 64x200′, of steel frame on concrete foundations, houses Crossley gas engines of 1,920 h. p. Two 100-h. p. engines drive the blowers, which are connected with the furnaces by a 300′ blast-main, a third engine of the same size being kept in reserve as an auxiliary. Two 200-h. p. engines furnish electric power, generated at a voltage of 250, stepped up to 2,500 volts at the power-house and carried by 4 feed wires to a second set of transformers at the West Yankee mine, where it is stepped down to 250 volts, and distributed to the various shafts, tunnels and surface plants. A 500-h. p. engine drives the air-compressor that furnishes blast, at 8 lbs. pressure, to the converters.

The concentrator, at Morenci, has been rebuilt in two sections, each unit having about 500 tons daily capacity. The concentrator has a floor area of 166x240′, with Chilean mills, 6 sets of 16x42″ rolls, 28 revolving screens, 80 Frue vanners and 40 Wilfley tables, with room for 50 more. Only 400 gallons of water are used in concentrating one ton of ore, about 1,800 gallons of water being in constant use, 125 gallons per minute of clear water being supplemented by clarified water from ingenious and highly effective settling ponds and clarifiers, designed by Mr. Hunt. The mill is designed to concentrate ore as low as 2% in copper tenor, and puts about 7 into 1. Water for the mill is pumped from wells on the San Francisco river, and at the pumping plant Foster superheaters, placed in the setting of the Stirling water-tube boilers, are giving excellent results.

The sampling mill, above the concentrator, takes ore from the latter by a 400′ belt conveyor. Both concentrator and sampler are run throughout by electricity, furnished by a plant having four 150-h. p. gas engines. The sampler has a capacity of about 100 tons per hour. Experiments were

conducted, in 1904, with oil concentration, but did not lead to the adoption of the process.

The smelter has four 54x144″ blast-furnaces and one 42x264″ furnace. Blast is furnished by a 250-h. p. gas engine and an electric motor. A converting plant is being added. About 57% of the ore is smelted as concentrates, and flue-dust is briquetted for resmelting. The smelter has an electric light plant and is thoroughly modern in equipment, with 2,000-ton ore-bins and a steel trestle.

A 36″ gauge railway connects the mines and smelter with the Arizona & New Mexico railroad, at Guthrie. This line has a maximum grade of 3.5% and has 4 complete loops within an air-line distance of one and one-half miles, near Morenci. The company operates a mammoth department store and an excellent hotel, and also maintains a library, gymnasium and club-room for employes. Production of refined copper was 16,623,251 lbs. in 1904, and 14,692,421 lbs. in 1905. The property is managed with great skill, and is an exceptionally fine example of a successful low-grade mine.

DETROIT & PARRY SOUND MINING CO., LTD. **ONTARIO.**

Office: 311 Wetherbee Bldg., Detroit, Mich. W. A. Phillips, president; H. C. Morris, vice-president; E. A. Covell, secretary; D. M. Pickett, superintendent. Organized June 3, 1903, under laws of South Dakota, with capitalization $3,000,000, shares $1 par; issued, $490,750. Lands, in the Parry Sound district of Ontario, have given specimens of ore assaying well in copper.

DEVON UNITED MINES SYNDICATE, LTD. **ENGLAND.**

Offices: 6, Pall Mall, London, S. W., Eng. E. B. Haynes, chairman; F. N. B. Hill, secretary; G. W. Ladds, mine manager. Organized June 10, 1901, with capitalization £10,000, shares £1 par; issued, £7,797. Debentures, £5,000 authorized; £4,960 issued, at 6%. Lands, 100 acres, on the river Tavy, Devonshire, England, carrying tin, copper and arsenic ores, including the South mine, a tin property, and the Central mine, latter being considered the most promising copper prospect opened in Cornwall for some years. Has a tin-mill with 28 stamps, but requires additional milling facilities, and probably could use a few thousand pounds cash to advantage.

DEWEY CITY MINING CO. **COLORADO.**

Mine office: Gunnison, Gunnison Co., Colo.

DEWEY CONSOLIDATED COPPER & GOLD MINING & MILLING CO. **IDAHO.**

Letter returned unclaimed from former office, Salt Lake City, Utah. Mine office: Grangeville, Idaho Co., Idaho.

DEWEY MINE. **COLORADO.**

Mine office: Saratoga, Carbon Co., Wyo. Capitalization $400,000, shares $1 par. Lands, sundry claims, circa 15 miles southeast of Saratoga. Idle.

DEWEY MINE. **UTAH.**

Mine office: Ibapah, Tooele Co., Utah. Presumably idle.

DEWEY MINING CO. **IDAHO.**

Letter returned unclaimed from former mine office, Bear, Idaho.

DEWEY & OLYMPIA GROUP. **NEW MEXICO.**

Office and mine: care of U. E. McDaniel, owner and manager, Cooks, Grant Co., New Mexico. Ores carry gold, silver, lead, copper and zinc. Has steam power and a 25-ton concentrator.

DIAMOND JOE MINE. **ARKANSAS.**

Office: care of Frank Pease, Silver City, Montgomery Co., Ark. Lands show ores carrying silver, lead and copper. Idle, at last accounts.

DICKERSON MINING CO. **MONTANA.**

Mine office: care of J. W. Dickerson, manager, Basin, Jefferson Co., Mont. Lands are developed by tunnel. Has steam and water power. Idle.

DILL GOLD & COPPER MINING CO. **WYOMING.**

Office: Prescott, Wis. Mine office: Rambler, Carbon Co., Wyo. W. T. Dill, president; Geo. S. Hollister, vice-president and treasurer; Edw. H. Wallace, secretary; Sören J. Sörenson, manager. Organized July, 1903, under laws of Wyoming, with capitalization $1,500,000, shares $1 par. Lands, 4 claims, in process of patenting, area 80 acres, lying immediately north of the Doane, in the Battle Lake district, opened by a 100′ tunnel and shafts of 42′ and 100′, and said to have upwards of 1,000′ of workings, showing several quartz veins, carrying more or less copper. Has a 40-h. p. boiler, 6x8″ hoist and Cameron sinking pump. Idle.

DILLON CONSOLIDATED MINING & TUNNEL CO. **WYOMING.**

Mine office: Dillon, Carbon Co., Wyo. Organized 1904, to drive a 3,500′ tunnel across the formation at Dillon, to cut 6 copper veins, located on surface. Apparently no work ever done.

DINGO COPPER MINING CO. **AUSTRALIA.**

Mine office: Essington, Rockley district, N. S. W., Australia. Produced circa 200 tons of high-grade hand-picked ore in 1901. Presumably idle.

DIRIGO-LA SAL GOLD & COPPER MINING CO. **UTAH.**

Office: care of C. S. Richardson, secretary, Salt Lake City, Utah. Geo. E. McCann, manager. Lands, 31 claims, area circa 600 acres, in the Deep Creek district of Utah.

DIVIDEND MINING & MILLING CO. **NEW MEXICO.**

Office: 65 Journal Bldg., Boston, Mass. Mine office: Estey, Socorro Co., N. M. J. M. Bryson, president; J. E. Simpson, vice-president; B. F. Coburn, secretary and treasurer; preceding officers, F. B. Street, J. Wm. Rice, Samuel Porter, A. G. Spear, Jas. E. Putman and Halbert E. Parkhurst, directors. Organized September, 1902, with capitalization $3,000,000. Has authorized a $150,000 bond issue, for five years, at 7%.

Lands, circa 2,000 acres, also sundry coal lands about 15 miles distant. About $250,000 is supposed to have been expended on the mine, which shows a fair body of sulphide ore, carrying high values in copper, a little lead, and small values in gold and silver. Property has a 100-ton concentrator

and a small smelter, inherited from previous owners, the Estey Mining & Milling Co., and is said to plan installation of a larger smelter.

Property is considered a promising one, but the management is selling stock, yet declines to give a statement to the Copper Handbook, claiming that the company's business is its own affair. The advertising done by this company is indefensible, and must injure its standing in the eyes of all conservative investors. The company advertised, in the Boston newspapers, that it had received a shipment of "precious rich, virgin copper ore, taken from the Mocking Bird mine, in the famous copper strike, which is the biggest ever made in the southwest," also that "there has been no such opportunity for investment since the Calumet & Hecla and United Verde were first put on the market." Verbum sap.

DIXIE MINE. **UTAH.**

Owned by Utah & Eastern Copper Co.

DOANE MINE. **WYOMING.**

Controlled by Penn-Wyoming Copper Co.

DOANE-RAMBLER MINE. **WYOMING.**

Controlled by Penn-Wyoming Copper Co.

DOANE-VERDE MINING CO. **WYOMING.**

Office: 1301 Monadnock Bldg., Chicago, Ills. Letter returned unclaimed from former mine office, Rambler, Carbon Co., Wyo. John C. Clarke, president; Oliver S. Brown, vice-president; Robert H. Young, general manager. Organized June, 1902, under laws of Wyoming, with capitalization $1,500,000, shares $1 par. Lands, 7 claims, on which a little development work was done, in the hope of striking the extension of the Doane-Rambler ore body. Idle for several years.

DR. CARL PETERS ESTATES & EXPLORATION CO., LTD. **MOZAMBIQUE.**

Title changed, October, 1903, to South-East Africa, Ltd.

DOGAMARU MINE. **JAPAN.**

Mine office: Ago-mura, Ochi-gori, Iwami, Japan. B. Hori, owner; J. Stajaki, general manager. Opened circa 1845, reopened 1873. Ore is chalcopyrite, associated with argentiferous galena, sphalerite, and iron pyrites, with quartz gangue. Principal vein, of 10′ to 25′ width, traverses granite-porphyry, with frequent faults. Has steam and electric power and a small smelter, employing circa 600 hands. Production, 1900, was 551,164 lbs. fine copper and 16,056 momme fine silver.

DOGSKIN MINE. **NEVADA.**

Mine office: Reno, Washoe Co., Nev. Has copper-gold ores. Idle.

DOLCOATH MINES, LTD. **ENGLAND.**

Offices: 28, St. Swithin's Lane, London, E. C., Eng. Mine office: Camborne, Cornwall, Eng. F. Harvey, chairman; Oliver Wethered, vice-chairman; F. W. Thomas, secretary; R. A. Thomas, mine manager. Organized July 15, 1895, with capitalization £350,000, shares £1 par; issued, £285,114. Lands include the Dolcoath mine, held on a 60-year lease expiring June, 1955, under royalty, and the West Dolcoath mine, bought 1899.

Is the principal mine of Cornwall, and is a large producer of tin, also securing a little copper as a by-product. Main shaft is nearly one-half mile in depth. Net profits, for fiscal year 1905, were £13,720, and a 5% dividend was paid therefrom, last previous dividend having been 13%, in 1899.

DOLLY B. MINE. **COLORADO.**

Mine office: Leadville, Lake Co., Colo. P. K. Connelly, manager. Ores carry gold, silver, lead and copper. Has steam and electric power.

DOLLY HYDE MINE. **MARYLAND.**

Located in Frederick county, Maryland, and was the principal copper mine of the state, though never a large producer. Ores occur as malachite, bornite and chalcopyrite, in limestone country rock. Idle for many years.

DOLLY VARDEN MINE. **COLORADO.**

Mine office: Sunset, Boulder Co., Colo. Garner & Ewing, owners; L. A. Ewing, manager. Ores carry gold and copper. Has steam power.

DOLORES COPPER MINING CO. **MEXICO.**

Dead. Property, at Matehuala, San Luis Potosí, Mexico, sold to Guggenheim Exploration Co.

DOMINGUEZ COPPER MINING CO. **COLORADO.**

Mine office: Delta, Delta Co., Colo. Lands, sundry claims near Dominguez Cañon. Idle for several years.

DOMINION COPPER CO., LTD. **BRITISH COLUMBIA.**

Office: care of Leopold Herrman, secretary and treasurer, 30 Broad St., New York. Mine office: Phoenix, B. C. Works office: Boundary Falls, Yale district, B. C. Employs 120 men. Hon. Warner Miller, president; Samuel Newhouse, general manager; Maurice M. Johnson, consulting engineer; Thos. R. Drummond, superintendent; John H. Sampson, mine superintendent; Wm. C. Thomas, smelter superintendent; Gerald B. Street, engineer. Was reorganized, 1906, with capitalization $5,000,000, shares $10 par. Bonds, $1,000,000 authorized, at 6%, for 10 years: issued, $100,000, sold to shareholders at $90, accompanied by a bonus of $200 in stock. Controls upwards of 75% of the shares of the Montreal & Boston Consolidated Mining & Smelting Co., Ltd., and probably will buy the balance and absorb the property of that company completely. Former officers of the company are alleged to have been dishonest, and a criminal action for an accounting has been brought against H. T. Pemberton, formerly general manager.

Lands, 15 claims, area 500 acres, also a smelter-site. Mining lands are in four groups, in the Phœnix, Deadwood, Wellington and Summit camps. Country rocks are limestone and greenstone, ore bodies occuring as contact veins, and largely as replacements in the greenstone. There are 8 different veins on the company's lands, all more or less developed, these having a generally north and south strike, with an average dip of about 40°, and averaging about 25′ in width by 3,000′ in known length.

The properties in the Phoenix camp are the Brooklyn, Stemwinder, Rawhide, Idaho, Montezuma and Standard mines, with an area of 363 acres. The Brooklyn mine has a 430′ main shaft, with about 3,500′ of workings, showing a 40′ vein averaging circa 1.43% copper, 25c. silver and $1.32 gold

per ton. Mine has reserves of 260,000 tons of ore, of about $6 average value, and is producing about 250 tons daily.

The Stemwinder mine has a 200′ shaft, with 1,200′ of underground openings, on a vein parallel with and about 1,000′ east of the Brooklyn vein, ore giving average assays of 1.4% copper, 25c. silver and $1 gold per ton. Production is about 50 tons daily.

The Rawhide mine has a 180′ shaft, with 600′ of workings, exposing about 225,000 tons of ore averaging 1.4% copper, 25c. silver and 90c. gold per ton. Equipment includes a 500′ Ingersoll-Sergeant air-compressor, operated by electric power.

The Idaho mine adjoins the Brooklyn and Granby mines. Development is by surface-cuts, with one short tunnel. The property is considered promising.

The Montezuma and Standard claims are but slightly developed.

The properties in the Deadwood camp include the Sunset, C. O. D., Crown Silver and Morrison mines, with a total area of 110 acres. The Sunset has shafts of 200′ and 412′, with large opencast workings, showing a large ore body, which is chiefly valuable for fluxing, the ore carrying an excess of iron, silica and lime, with small copper, silver and gold values. A trestle from the Sunset runs to a 2,000-ton ore-bin on the railroad siding, whence ore is shipped to the smelter. Mine equipment includes a 14x20″ Jenckes duplex link-motion hoist, a 14x20″ Lidgerwood double-cylinder hoist, and a 10-drill Ingersoll-Sergeant duplex air-compressor. Production is about 60 tons of ore daily.

The Crown Silver mine, adjoining the Sunset, has a 265′ main shaft and an 880′ tunnel, and to all practical intents and purposes is a part of the Sunset.

The Morrison mine is opened by a 230′ shaft, with 4,300′ of tunnels, showing about 250,000 tons of ore averaging about 0.6% copper, 0.5 oz. to 1 oz. silver and 0.2 oz. gold per ton, with an average value of about $4 per ton. Equipment includes a 110-h. p. steam plant, with 7x9″ hoist, and a 5-drill Rand air-compressor.

Property in the Summit camp includes a half interest in the Lancashire and a three-fourths interest in the Mountain Rose mine, with combined area of 74 acres. Ores of these mines are chiefly useful for fluxing, containing about 40% iron, with very small values in copper, silver and gold. The Mountain Rose shows a vein of about 20′ width, and the Lancashire, which is slightly developed, shows a 15′ vein of the same character.

The Athelstan and Jack Pot mines, area 34 acres, in the Wellington camp, are worked open-cast. These properties show a large outcrop of oxidized ore carrying low values in copper and silver, with $7.50 gold per ton, and are expected to show low grade auriferous and argentiferous copper ores below the oxidized zone.

The smelter, at Boundary Falls, is 4 miles to 25 miles from the various mines. Connection is by the Canadian Pacific Railway, which gives a freight rate of 17c. per ton on Deadwood ore and 30c. per ton on ore from the

Phoenix and Summit camps. The smelter was much crowded for slag-room, but extra land has been secured therefor. The smelter was not properly located, or equipped, but is being overhauled and modernized by the present management. The plant was built by the Standard Pyritic Smelting Co., passing latter to the Montreal & Boston company. The plant is rated at 650 tons daily capacity, and is equipped with two 325-ton water-jacket blast-furnaces, 40x176″ at the tuyeres, and a third furnace, 48x204″, to be installed, will have a daily capacity of about 500 tons. The building is 120x182′, having 16 ore-bins, each 10x24′, in the building, and three large ore-bins and coke-bins outside, with railroad tracks running above. The dust-flue, 200′ long, leads to a stack 112′ high and 9′ 6″ in diameter. Slag is handled by a 7x12″ locomotive, traversing a 40″ track. Equipment includes a sampling plant, with crushers, rolls, Vezin and Bridgman automatic samplers, and belt conveyors. The smelter has No. 7 Connersville blowers and a 250-light dynamo. A new machine shop is being built, and more extensive use will be made of electric power. The smelter works three 8-hour shifts, and product is a matte carrying about 45% copper, 13 oz. silver and 3 oz. gold per ton, which is shipped to the British Columbia smelter, at Greenwood, for refining. The smelter also does custom work.

Under the present management, the first furnace was blown in December 7, 1905, and the second in January, 1906. Net profits of $17,400 are said to have been made from 15,000 tons ore smelted in January, 1906, and in April, 1906, the smelter was treating 650 tons daily, which will be increased to 1,100 tons during the year, and management estimates production for 1906 at about 5,000,000 lbs. fine copper. The new management is strong financially, and has the experience and ability to develop and equip the property adequately. It is expected that about $1,000,000 will be expended in new work and equipment. The mines of this company, while very low in average grade, contain immense bodies of ore, and the property should become a large and profitable producer.

DON CARLOS & EUREKA CONSOLIDATED COPPER MINING CO. **MEXICO.**

Office: care of Sidney Witherbee, Detroit, Mich. Mine office: Nombre de Dios, Durango, Mex. Property includes the Don Carlos y Anexa, Eureka and other mines, located about 65 miles southeast of Durango. Vein is about 150′ wide, and mixed, carrying small stringers and pockets of high-grade bornite, with gold and silver values, asssaying 18% copper, 3 kgs. silver and 7 grams gold per ton. Production, about 75 tons of ore in three years. Property presumably idle.

DON CARLOS MINE. **MEXICO.**

Office: care of Avery T. Holmes, owner, Laramie, Wyo. Mine office: Nacozari, Sonora, Mex. Main shaft, 120′, shows ore running up to 43% copper, and from 60 oz. to 7,000 oz. silver per ton. Has shipped several carloads of high-grade ore to the El Paso smelter.

DON FULANO COPPER MINES, LTD. **SPAIN.**

Offices: Dashwood House, London, E. C., Eng. Col. C. E. MacDonald,

chairman; C. J. Gersbach, secretary. Organized July 7, 1905, with capitalization £130,000, shares £1 par. Lands are sundry old Spanish copper mines.

DON JUAN MINE. **OREGON.**

Mine office: Geiser, Baker Co., Ore. N. H. Thibault, owner; D. D. McLeod, superintendent. Ores carry gold and copper. Has steam power and a 10-stamp mill.

DONA DORA MINING CO. **NEW MEXICO.**

Office: 220 Broadway, New York. Mine office: Kent, Donna Ana Co., N. M. Jos. Willetts, president; Edwin L. Scott, secretary and treasurer; G. W. Kent, general manager. Lands are sundry claims on the eastern slope of the Organ Mountains, developed by a 400′ tunnel and a shallow shaft, on a 5′ vein carrying copper, lead and gold values. Equipment includes a 150-ton concentrator, in process of erection, a 100-h. p. hoist, 10-drill Rand air-compressor and a small electric light plant.

DONA LOUISA COPPER & GOLD MINING CO. **MEXICO.**

Office: 42 Broadway, New York. Mine office: Coapa, Michoacán, Mex. Wm. A. Buckman, president; Chas. M. Heath, vice-president; Manuel L. Ward, secretary, treasurer and general manager; Patrick McKinney, superintendent; T. Richmond Crum, engineer. Organized April, 1903, under laws of Delaware, with capitalization $1,500,000, shares $5 par. Has paid dividends of $4,200, on treasury stock, and is still selling shares.

Lands, 45 pertenencias, area 111 acres, in the Morelia district, 24 miles from the Mexican National Railway, but construction of a new line is planned from Morelia to Tacambaro. Lands show 4 fissure veins, of which 2 are being developed, these averaging 3′ width and giving assays of 9% to 63% copper, and up to 120 oz. silver and $32 gold per ton, from oxidized ores, slightly developed by shafts and tunnels, recently retimbered. Equipment includes a 60-h. p. boiler, Lidgerwood hoist good for 1,000′, and Cameron pumps. A 5-ton test shipment, January, 1906, netted $59.62 per ton, and it is hoped to make regular shipments during 1906. Development and equipment of the mine seems to have been sensibly done, but the management is making the mistake of paying 10% dividends while selling stock, which naturally gives the property a bad standing, in the eyes of conservative investors.

DORA COPPER MINES, LTD. **TRANSVAAL.**

Offices: 34, Coleman St., London, E. C., Eng. Mine office: Pretoria, Transvaal, South Africa. W. Vaughan-Williams, chairman; J. H. Bailey, secretary. Organized May 10, 1905, with capitalization £150,000, shares £1 par; issued, £100,010. Lands, sundry undeveloped copper claims in the vicinity of Pretoria.

DORAN & GALLAGHER. **ARIZONA.**

Mine office: Paradise, Cochise Co, Arizona. Lands, 10 claims, opened by a 40′ shaft and a 250′ tunnel, showing melaconite assaying 10% and better in copper.

GEWERKSCHAFT DES BLEI- UND KUPFER-ERZBERGWERKE DOROTHEA. **GERMANY.**

Mine office: Jannowitz, Schlesien, Germany. Herman Schönfelder, agent. Has one shaft. Idle at last accounts.

DOROTHY MINE. **VIRGINIA.**

Mine office: Virgilina, Halifax Co., Va. Shipped a small quantity of sulphide ore in 1900. Idle.

DOS CABEZOS CONSOLIDATED MINES CO. **ARIZONA.**

Mine office: Dos Cabezos, Cochise Co., Ariz. Oscar W. Roberts, superintendent. Has auriferous and argentiferous copper ores, with steam power and a small smelter. Property considered promising. Idle.

DOS NACIONES MINING CO. **MEXICO.**

Office: care of Pritchard, Hagen & Co., Bisbee, Ariz. Letter returned unclaimed from former mine office, La Cananea, Sonora, Mexico. Lands, sundry claims not far from the Cobre Grande mine of the Greene Consolidated, developed by a 115′ shaft, bottomed in ore.

DOUBLE STANDARD GROUP. **ARIZONA.**

Office and mines: Lochiel, Santa Cruz Co., Ariz. Frank Olsen, owner and manager. Ores carry copper, silver and lead. Presumably idle.

DOUGLAS COPPER CO. **MEXICO.**

Office: 42 Broadway, New York. Mine office: Cocorit, Alamos, Sonora, Mexico. Theo. Douglas, president and general manager; Melbert B. Carey, first vice-president; Victor M. Tyler, second vice-president; John C. Rowe, secretary; Chas. Switzer, treasurer; Gustave M. Gouyard, consulting engineer; preceding officers, E. C. Frisbie, Max Muller, A. Heaton Robertson and John C. Rowe, directors; O. J. Riggs, mine superintendent; M. G. Magnuson, engineer; Eaton & Lewis and Fidel S. Pujol, counsel; Empire Trust Co., New York, registrar; American Audit Co., New York, auditor. Organized July 23, 1903, under laws of Maine, with capitalization $3,000,000, shares $5 par. Bonds, $600,000 authorized, at 6%, dated September 1, 1904, due September 1, 1914, secured by first mortgage; issued, $377,000. Statement, as of March 1, 1906, gave cash in depositories, $166,478.21, with $18,042.75 accounts receivable. Owns entire stock issue of Anita Copper Mines Co., S. A., which is the Mexican corporation of the Douglas Copper Co. Annual meeting, third Tuesday in January.

Lands, 494 acres of mining lands, a 115-acre millsite and 19,760 acres of ranch, timber and coal lands, in the Baroyeca division of the Alamos district. Ore bodies occur in a crush-zone, in series of bedded eruptives, consisting of diorite, andesite and trachyte, carrying various contact veins and replacements in the diorite, and showing a mineralized zone of about 115′ average width, carrying cuprite, melaconite, malachite, azurite, chalcocite, covellite, bornite, chalcopyrite, brochantite and chrysocolla, from which average assays have been secured of 8.5% copper, 5.5 oz. silver and $5 gold per ton. A 20-ton sample shipment, to the El Paso smelter, in 1905, gave returns of 22.2% copper, 7.4 oz. silver and 4.5 oz. gold per ton,

Development is by 5 shafts, No. 1, the main shaft, being about 600′ deep. with nearly one mile of underground openings, estimated by management to place about 400,000 tons of ore in sight. Equipment includes steam and electric hoists, air-compressor, electric light plant, necessary shops and offices and 21 dwellings.

Property is some distance from the railway, but is expected to be served by a new line building from Guaymas. On March 9, 1906, management rtated that installation of the first 250-ton unit of a 1,000-ton smelter was being started, this being planned to go into blast before close of the year. Previous statements in the press that the mine was concentrating and smelting 500 tons of ore daily were absolutely unfounded. Property is regarded as valuable, and the management seems efficient and progressive, but the standing of the company has been injured by brass-band methods of promotion.

DOUGLAS COPPER MINING CO. **NEVADA.**

Office: care of Thompson Campbell, receiver, Boston, Mass. Mine office: Yerington, Lyon Co., Nevada. Apparently succeeded the Douglas Mining & Smelting Co. Lands, 11 claims, considerably developed by tunnels, showing argentiferous and auriferous copper ores. Reduction plant is the old Bluestone smelter. Mine is 15 miles from the Southern Pacific Railway, with a freight rate of $5 per ton to the road and $5 railroad freight to the Salt Lake smelter. Ore is slightly auriferous and argentiferous covellite, running up to 50% copper, and the average of 1,000 tons shipped in 1905 was 14.5% copper.

DOUGLAS MINING & MILLING CO. **WYOMING.**

Mine office: Rambler, Carbon Co., Wyo. O. G. Blaisdell, superintendent. Lands, adjoining the Rambler, in the Douglas Creek district, have shown cuprite carrying good assay values in gold. Idle.

DOUGLAS MINING & SMELTING CO. **NEVADA.**

Succeeded by Douglas Copper Mining Co., latter bankrupt, 1905.

DOUGLAS MOUNTAIN GOLD MINING & TUNNEL CO. **WASHINGTON.**

Office: 38 West Gay St., Columbus, Ohio. Mine office: Loomis, Okanogan county, Wash. G. E. Bazler, general manager; J. J. Bennett, superintendent. Lands, 20 claims, showing several veins of 7″ to 8′ width. A 50′ tunnel, on the Little Falls claim, shows a 2′ vein carrying auriferous chalcopyrite, galena and iron pyrites. Management plans instalation of a machinery plant.

DOUGLAS REDUCTION WORKS. **ARIZONA.**

The metallurgical plant of the Copper Queen Consolidated Mining Co.

DOVER MINING CO. **COLORADO.**

Mine office: Idaho Springs, Clear Creek Co., Colo. David Ellis, superintendent. Ores carry gold, silver and copper. Has steam power.

DRAGOON COPPER CO.

Office: 924 Columbus Ave., Boston, Mass. Moribund.

DRAGOON COPPER MINING & SMELTING CO. **ARIZONA.**

Office: 310 Frost Bldg., Los Angeles, Cal. Mine office: Tombstone,

Cochise Co., Arizona. C. M. Renaud, president; W. Arthur Phipps, vice-president; G. H. Mosher, secretary and treasurer; Geo. M. Henry, general manager. Organized May, 1902, under laws of Arizona, with capitalization $2,000,000, shares $1 par. Lands, 20 claims, area 400 acres, near the Middlemarch and opposite the Black Diamond, showing 3 contact veins between limestone and porphyry, giving assays of 16% copper, 11% lead and 14 oz. silver per ton, from azurite, malachite, bornite and chalcopyrite. Has 4 short tunnels and a 465′ shaft, showing high-grade ore at bottom. Has steam power and a 34-h. p. hoist, good for depth of 1,000′. Is shipping ore, said to average about $14 per ton, to the Copper Queen smelter, at Douglas. Money for operations, since 1903, has come mainly from advances of the directors, and company's financial condition is poor, but property is considered meritorious.

DRAGOON MINING CO. **ARIZONA.**

Office: 261 Broadway, New York. Mine office: Johnson, Cochise Co., Arizona. Geo. M. Jacocks, president; L. M. Clifford, general manager. Is controlled by Federal Copper Mining & Smelting Co. Idle.

DRAGOON MOUNTAIN MINING CO. **ARIZONA.**

Office: 533 Kearney St., San Francisco, Cal. Mine office: Pearce, Cochise Co., Ariz. Employs 12 men. Lee Wee, president; Chu C. Mow, vice-president; Louis Fon, secretary; Leung Ting Mai, treasurer; S. E. Lake, superintendent; California Safe Deposit & Trust Co., depositary. Organized under laws of Arizona, with capitalization $300,000. Lands are sundry claims near Middle Pass, in the Dragoon Mountains, opened by shaft and giving a promising showing of ores carrying copper, silver and gold. Company was organized by wealthy Chinese residents of San Francisco and Tombstone, Arizona, and is operating along business-like and modern lines. Production was begun, late in 1905, ores being hauled in wagons to Pearce, and shipped, via Benson, to the Copper Queen smelter, at Douglas, Arizona.

DROGSET KOBBERVAERK. **NORWAY.**

Mine office: Meldalen, Norway. Produced 2,718 tons of cupriferous pyrites in 1900. Presumably idle.

DRUMMERS DEVELOPMENT CO. **WASHINGTON.**

Office: 15 Jamison Bldg., Spokane, Wash. Mine office: Chelan, Chelan Co., Wash. R. D. Johnson, president; Thomas Maloney, secretary. Capitalization $100,000, shares 10c. par. Development work has been very limited, but shows fair ore. Idle at last accounts.

DUBUQUE MINE. **COLORADO.**

Mine office: Idaho Springs, Clear Creek Co., Colo. Is said to have a 3′ paystreak, on the 6′ Dubuque vein, carrying native copper and melaconite, with good gold values.

DUCHESS MINING, MILLING & SMELTING CO. **WYOMING.**

Letters returned unclaimed from former office, Cheyenne, Wyo., and former mine office, Holmes, Albany Co., Wyo. Lands lie west of the Blanche.

DUCKTOWN COPPER MINES. **GEORGIA**

Mine office Pierceville, Fannin Co., Ga. Lands show sulphide ore slightly developed by shaft. Has steam power. Idle.

DUCKTOWN SULPHUR, COPPER, & IRON CO., LTD. **TENNESSEE**

Offices: 1, Gresham House, Old Broad St., London, E. C., Eng. Mine office: Isabella, Polk Co., Tenn. Col. Jas. LeGeyt Daniell, chairman H. Godber, secretary: Joseph Gordon Gordon, managing director: Jas. Worley auditor; W. H. Freeland, general manager; Chas. W. Kennrick, assistant general manager. Organized Feb. 16, 1891, with capitalization £75,000, shares £1 par; issued, £66,200, in 74,800 ordinary shares and 200 founders' of £1 each, profits being divisible on a basis of 7% plus one-half of net remaining profits to the ordinary shares, balance of profits going to the founders' shares. Debentures; £38,300, first mortgage, at 5% and £7,735 second mortgage, at 7%. Has paid dividends of 963% on issued ordinary capital, last dividend being 30%, in 1905, and has paid dividends of 19,114% on the founders' shares.

Lands include the Mary, Callowell and other mines, acquired at a cost of £68,057. Main shaft is 600′ deep and ores are exclusively sulphide, averaging under 3% copper, without either other gold or silver values. Has steam and electric power. Smelter has a Herreshoff furnace with daily capacity of about 500 tons of crude ore, and a No. 6 Connersville blower driven by a direct-connected engine. An important change in the smelting process was made in 1903, and instead of heap-roasting the ores, as formerly, the pyritic system is employed, this making a 20% matte in the first fusion and a 50% matte in the second fusion, the change in smelting methods cutting down the capacity of the furnace, but effecting a considerable economy in fuel charges. The change from roasted to raw ore is said to have effected a saving of about 3 cents per pound on the refined copper production. The process, and its intelligent and highly successful application, in both theory and practice, have been highly commended by metallurgists. The furnace at first lost 48% in tonnage efficiency, but this has been reduced to 16.5% net loss only. The smelter may be enlarged. In connection with the reduction works is a small acid plant. Production was 5,287,321 lbs. fine copper, in 1904, and 6,547,212 lbs. in 1905. The property is managed with great ability, and ranks second only to the Tennessee, as a producer, in the Appalachian field.

DUGWAY COPPER MINING CO. **UTAH.**

O. F. Peterson, general manager. Lands are in the Deep Creek district of Utah. Has a 100′ shaft on a 15′ contact vein between limestone and porphyry. Ores assay 1% to 36% copper, up to 45% lead, 17 oz. silver and $1.60 gold per ton. Presumably idle.

DUKE MINE. **NORTH CAROLINA.**

Mine office: Roxboro, Person county, N. C. B. L. Duke, owner; Thos. Martin, superintendent. Lands, 470 acres. Property has 4 shafts, deepest 170′. Veins are fissures, ore having a gangue of quartz, epidote and calcite. Has a good steam power equipment. Presumably idle.

and silver. Has a new 1,000′ main working shaft, bottomed in a 6′ vein carrying ores of $25 to $30 per ton average value. The mine has considerable ore reserves, which are being increased steadily, and at the beginning of 1906 was shipping about 50 tons of silicious ore daily. Property has a powerful hoist and an adequate machinery plant.

EAGLE COPPER CO. **WYOMING.**

Office: 1608 Wazee St., Denver, Colo. Letters returned unclaimed from former mine offices, Battle and Encampment, Carbon Co., Wyo. Property is the Gertrude mine, carrying auriferous copper ores, opened by two shallow shafts and equipped with a small steam plant.

EAGLE COPPER & GOLD MINING CO. **IDAHO.**

Office: Wallace, Idaho. Mine office: Mullan, Shoshone Co., Idaho. Organized 1902, under laws of Idaho, by J. H. Nordquist, et al., with capitalization $1,000,000, shares $1 par. Lands, sundry claims near the Leslie, opened by a 150′ tunnel, showing copper ore, associated with hematite.

EAGLE COPPER-GOLD MINING CO., OF ARIZONA. **ARIZONA.**

Office: 1022 Garfield Bldg., Cleveland, Ohio. Mine office: Wickenburg, Maricopa Co., Arizona. Alex. M. Fulford, president; Benj. J. Perry, vice-president and general manager; Herbert E. Hudson, secretary and treasurer; Oscar Jennings, superintendent. Organized August, 1902, under laws of South Dakota, with capitalization $1,000,000, shares $1 par. Lands, 5 claims, area 95 acres, in the Blue Tank district, claimed to show 8 ore bodies, of which the principal one is said to be of 12′ to 20′ width, and to give assays of 10% copper, 10 oz. to 35 oz. silver and $6 to $18 gold per ton, from oxide, carbonate and sulphide ores, developed by shafts of 50′ and 108′. Is not favorably regarded.

EAGLE COPPER MINING CO. **WASHINGTON.**

Mine office: Chewelah, Stevens Co., Wash. M. Mitchell, superintendent. Lands, 3 claims, lying south of the Wonderful group, on Stevens Peak, opened by shaft and tunnel, showing auriferous and argentiferous lead and copper ores.

EAGLE METALLIC COPPER CO. **PENNSYLVANIA.**

Letter returned unclaimed from former office, Belvidere, N. J. Henry D. Deshler, president; John S. Romig, treasurer; Miss Millie Deshler, secretary. Organized March, 1903, under laws of New Jersey, with capitalization $500,000. Lands, in Adams county, Pennsylvania, include an old copper mine, never successful. Some development was done 1903–1904, by present company.

EAGLE MINING CO. **CALIFORNIA.**

Mine office: Needles, San Bernardino Co., Cal. Presumably idle.

EAGLE RIVER COPPER CO. **MICHIGAN.**

Office: 15 William St., New York. Organized June 28, 1883, as successor to the Eagle River Mining Co. Lands, 360 acres, all in Keweenaw county. Large majority of stock in Eagle River Copper Co. was held by the Central Mining Co., which sold its lands, 1905, to the Calumet & Hecla Mining Co. Eagle River presumably absorbed also by Calumet & Hecla.

EAST BUTTE EXTENSION COPPER MINING CO. **MONTANA.**

Mine office: Butte, Silver Bow Co., Montana. Chas. J. Schatzlein, president: A. C. McCullom, vice-president; J. K. Heslet, treasurer; Frank H. Cooney, secretary and general manager. Organized April, 1906, under laws of Arizona, with capitalization $1,000,000, shares $1 par. Lands, sundry claims, held in fee and under bond and lease, lying west of the East Butte and between the Dutton, Belmont, and Pennsylvania mines, opened by the Wall, Kemper, Ramsdell, Maud S., and other shafts, mostly shallow. It is planned to develop by sinking a new 500′ shaft.

EAST BUTTE MINING CO. **MONTANA.**

Mine office: Butte, Silver Bow Co., Montana. Jas. A. Talbot, president; Frank M. Sullivan, secretary; Henry Mueller, treasurer; Patrick Wall, general manager; preceding officers and Chas. R. Leonard, directors; Jas. W. Neill, consulting engineer. Organized, circa 1905, under laws of Arizona, with capitalization $3,000,000, shares $10 par; issued, $2,000,000. Began business with $150,000 cash.

Lands include the Dutton mine and 9 other fractional claims, these 10 claims having an area of 19 acres, with options on other property, in the southeastern part of the Butte camp, adjoining the Pennsylvania mine of the Boston & Montana, having total holdings, in fee and under option, of circa 350 acres, said to carry 21 distinct veins. The various properties have 10 shafts, of 50′ to 350′ depth. Principal property is the Dutton mine, having a two-compartment shaft of 350′, which has been cut down to three compartments, and is to be sunk to 1,000′ or 1,500′ depth. It was expected that a depth of 500′ would be reached by July, 1906, and crosscuts would be driven from that depth. The property carries the extension of the Glengarry vein, which is about 20′ in width, with ore of rather low grade. The Oneida mine has a 250′ shaft and has yielded considerable rich ore, ranging up to 16% in copper tenor. The Lassen mine has produced a little ore carrying up to 60% copper and 10 oz. silver per ton. The Yankee Boy is claimed to show a 9′ vein of ore averaging 14% copper. The Yankee Boy property has an old 100-ton concentrator, and the management plans building a 500-ton concentrator, to cost about $135,000.

Several of the properties, including the Dutton, are being worked under lease, by tributors, and a monthly production of about $25,000 is secured by them, on which a net royalty of 25% is paid the company, this revenue providing for all ordinary development expenses. Published estimates of a daily production of 100 tons of 8% to 9% ore from lessees, are much too high. About one-half of the production is smelting ore and one-half milling ore. Company hopes to begin 1907 with a daily production of 300 to 500 tons of ore. Management is good and property is regarded as promising.

EAST COLUSA MINE. **MONTANA.**

Owned by Boston & Montana Copper & Silver Mining Co.

EAST PACIFIC MINE. **MONTANA.**

Mine office: Windsor, Broadwater Co., Montana. Robt. A. Bell,

owner; F. A. Taylor, superintendent. Ores carry gold, silver and copper. Has steam power and a 25-ton smelter.

EAST-SIDE GOLD MINING CO. **ARIZONA.**

Letter returned unclaimed from advertised office, Lambertville, N. J. Mine office: Bisbee, Cochise Co., Arizona. Chas. C. McCoy, president and general manager; E. C. Gallagher, secretary; W. A. Eckerly, assistant secretary and treasurer. Organized under laws of South Dakota, with capitalization $1,000,000, shares $1 par. Lands, 9 claims, area 168 acres, circa 6 miles east of Bisbee, opened by shafts of 60′ and 80′, showing veins said to give assays of $8 to $265 gold per ton, with small copper values. Idle.

EASTERN NATIONAL COPPER CO., LTD. **NOVA SCOTIA.**

Succeeded, 1904, by Cheticamp Copper Co., Ltd.

EASTERN STAR MINE. **ARIZONA.**

Letter returned unclaimed from former mine office, Williams, Arizona.

EASTER SUNDAY MINING CO. **ARIZONA.**

Office and mine: Bisbee, Cochise Co., Arizona. Has gold and copper ores. Idle, except for annual assessment work.

J. M. ECHEVARRIA. **CHILE.**

Operates the Quilomenco mine, opened 1892, in the department of Illapel, Chile. Production averages about 100 tons fine copper yearly.

ECHO COPPER MINING & MILLING CO. **WYOMING.**

Office: 413–95 Dearborn St., Chicago, Ills. Mine office: Rudefeha, Carbon Co., Wyo. Dr. Geo. Illingsworth, president; W. D. Meeker, vice-president; W. R. Stiles, secretary; W. T. Peryam, resident director. Organized December 21, 1902, under laws of Wyoming, with capitalization $1,000,000, shares $1 par. Lands, 4 claims, area 80 acres, adjoining and paralleling the Ferris-Haggarty mine on the northeast, opened by a 114′ shaft, showing copper stains.

ECHO GROUP. **WASHINGTON.**

Letter returned unclaimed from former mine office, Winthrop, Wash.

ECHO MINING CO. **IDAHO.**

Office and mine: Sandpoint, Kootenai Co., Idaho. John Elsasser president and superintendent; W. R. Elsasser, manager; Geo. M. Walker secretary. Lands, 4 claims, 2½ miles west of Sandpoint and three-fourths mile from Great Northern Railway. Has a fissure vein of 8′ to 13′ width, traversing granite, opened by tunnel and shaft, showing argentiferous and auriferous chalcopyrite and iron pyrites, with quartz gangue.

ECLIPSE-ARGO MINING CO. **MONTANA.**

Office: Helena, Montana. Mine office: Canyon Ferry, Broadwater Co., Mont. Employs 20 men. W. F. Quade, president; M. H. Riordan, vice-president; A. W. Martin, secretary; F. L. Sizer, treasurer and general manager; preceding officers, A. B. Tolin and A. B. Cottingham, directors. J. Hieber, mill superintendent. Organized March, 1904, under laws of Montana, with capitalization $300.000, shares $1 par, as a merger of the Argo Gold & Copper Mining Co. and the Eclipse Gold & Copper

Mining Co. Lands, 5 patented claims, area 100 acres, also a 10 acre millsite, in the Hellgate district, showing a 10′ fissure vein in slate, traced about one-half mile, carrying bornite and chalcopyrite, assaying about 7% copper, opened by tunnels of 300′ and 1,000′, with 2,000′ of workings. Has a 40-h. p. steam plant and a 40x85′ log mill, of 40 tons daily capacity, equipped with 2 crushers, 10 gravity stamps and one Wilfley table. Production, 1903, was 204,570 lbs. fine copper.

ECLIPSE GOLD & COPPER MINING CO. **MONTANA.**

Merged, 1904, in Eclipse-Argo Mining Co.

ECTON MINE. **ENGLAND.**

An old and idle property in Staffordshire, England, owned by the Duke of Devonshire. Was opened in Roman times, and operated as recently as 1840. Depth is about 1,500′. Was the first English mine to use gunpowder for blasting, A. D. 1677, and the first to use wire rope for hoisting.

EDDY GOLD, SILVER & COPPER MINING CO. **ARIZONA.**

Office: P. C. Box 596, Phœnix, Ariz. Mine office: Glendale, Maricopa Co., Ariz. F. L. Eddy, president and general manager; J. R. Aich, vice president, S. P. Donnell, secretary and treasurer. Organized Aug. 22, 1902, under laws of Arizona, with capitalization $1,000,000, shares $1 par. Lands, 10 claims, area 200 acres, also a 5-acre millsite, in the Frog Tank Mountains, Old Baldy district. Country rocks are porphyry and gneiss, showing a 3′ fissure vein in porphyry, opened by six 10′ pits, a shaft of 65′ and tunnels of 55′ and 105′, showing oxide and carbonate ores, assaying 4% to 6% copper, 12% to 60% lead, 10 oz. to 62 oz. silver and $5 to $32 gold per ton. Idle.

EDISON MINING CO. **BRITISH COLUMBIA.**

Mine office: Yreka, Vancouver Island, B. C. Lands adjoin the Yreka Copper Co., Ltd., and show good ore, Presumably idle.

EDMUNDIAN (MANICALAND) COPPER CO., LTD. **MOZAMBIQUE.**

Voluntarily liquidated, July, 1902.

EDNA MAY MINING CO. **COLORADO.**

Letter returned unclaimed from former mine office, Winfield, Colo.

EINASLEIGH EXPLORATION SYNDICATE, LTD. **AUSTRALIA.**

Offices: 20, Copthall Ave., London, E. C., Eng. W. H. Woodhead, managing director; Thos. Mullett, secretary. Organized Aug. 16, 1899, with capitalization £4,000, shares £50 par; issued, £3,850. Lands, 100 acres, on the Einasleigh river, Gilbert county, Queensland, Australia. Idle.

EINASLEIGH FREEHOLD COPPER MINES, LTD. **AUSTRALIA.**

Offices: 20, Copthall Ave., London, E. C., England, and A. M. P. Chambers, Edwards St., Brisbane, Queensland, Australia. Mine office: Einasleigh, Gilbert Co., Queensland, Australia. J. S. Smith-Winby, chairman: Wm. Henry Woodhead, managing director; Thos. Mullet, secretary; F. Hambridge, secretary in Brisbane; J. Adler, superintendent. Organized April 17, 1899, with capitalization £200,000, shares £1 par; issued, £180,000. Debentures, £32,000, at 6%. Lands, 120 acres, freehold, at junction of

Einasleigh and Copperfield rivers, also 20 acres adjacent, carrying iron ore for fluxing. Main shaft, 190'. Underground work has shown a promising ore body. Has a 32x75" water-jacket blast-furnace and made 104 long tons of copper and 1,330 oz. silver, from 1,009 tons of ore smelted, in 1901. Idle, but the proposed Etheridge extension of the Mareeba to Chillagoe Railway will pass within 12 miles, if built, and its construction doubtless would be followed by a resumption of work at the Einasleigh Freehold.

EINASLEIGH SOUTH BLOCKS. **AUSTRALIA.**

Mine office: Einasleigh, Gilbert Co., Queensland, Australia. Lands, sundry claims lying south of the Einasleigh Freehold. Idle.

EISENMANN y CARDEÑAS. **MEXICO.**

Mine office: Huacana, Ario, Michoacán, Mexico. Presumably idle.

EISFELDER KUPFERGEWERKSCHAFT. **GERMANY.**

Mine office: Glücksbrunn, Saxe-Meiningen, Germany. Capitalization, 600,000 marks. W. A. Mertens, smelter superintendent. Was sinking two working shafts, at last accounts.

EL CAPITAN COPPER CO. **ARIZONA.**

A swindle, perpetrated by the notorious Douglas, Lacey & Co. See description of Amalgamated Gold & Copper Co.

EL CARMEN COPPER CO. **MEXICO.**

Office: 52 Front St., New York. Mine office: El Carmen, San Juan de Heredia, Durango, Mex. Thos. P. Ball, president; Stephen A. Levy, secretary and treasurer; I. Wayne Von Leer, general manager. Organized August, 1899, under laws of New York, with capitalization $750,000, shares $100 par. Lands, 400 acres, also 31,000 acres miscellaneous lands. Development has shown a considerable body of auriferous and argentiferous copper ore, of concentrating grade. Has a large pumping plant, with a 3½-mile pipe-line, and a 40-stamp mill. Is 45 miles from a railroad. Idle.

EL CARMEN MINING CO. **MEXICO.**

Mine office: Los Bronces, via San Xavier, Sonora, Mexico. Organized 1905, under laws of Arizona.

EL COBRE MINES. **CUBA.**

Office: 71 Broadway, New York. Mine office: El Cobre, Santiago de Cuba. Employed 250 men, at last accounts. Chas. F. Rand, president and treasurer; Wm. Astor Chanler, vice-president; preceding officers, L. H. Severance, Colgate Hoyt, James C. Colgate, E. J. Barney, E. C. Felton, Wm. Henry Yale, E. W. Oglebay and Claudio G. Mendoza, directors; Wm. C. Tegethoff, secretary, Pedro Aguilera, manager; Jennings S. Cox, Jr., consulting engineer; Morrison B. Yung, mine superintendent; Chas. H. Jones, metallurgist. Organized Jan. 19, 1902, under laws of West Virginia, with capitalization $5,000,000, divided into $1,500,000 preferred and $3,500,000 common stock. Holdings of this company include the properties owned formerly by the Royal Consolidated Mines of El Cobre, Ltd., San José Mining Co., Santiago Copper Mining Co. and El Cobre Railroad Co. Annual meeting, first Tuesday in March.

El Cobre mines were opened by the Spanish, A. D. 1532, and probably

produced the first copper made in America, excepting the native copper taken from the Lake Superior mines by prehistoric workmen, the first product of the Cuban mines having been used for casting Spanish cannon. The properties were taken over, circa 1832, by a Hispano-English company, ore mined being shipped to Swansea for reduction. The custom-house records of Santiago are said to show exports of 610,210 tons of ore, valued at $50,186,225 (probably in depreciated Spanish currency) from 1851 to 1869, inclusive, ores as shipped assaying from 12.69% upwards, and probably averaging about 16% in copper tenor. During the revolution of 1868, the big Cornish pump was burned, causing the flooding of the mines, which remained idle until 1902, when bought by the present company.

Property is 8 miles west of Santiago bay, on which the company has wharves, and El Cobre railway, owned by this corporation, connects the mines with the harbor and with the city of Santiago. The property shows 3 wide veins, with strong outcroppings for a distance of some 6,500′. The old workings were extensive, including some 40 shafts, of which the four deepest were about 1,200′ each, with 17 miles of underground openings, the mine being timbered mainly with mahogany. During the rainy season the mine makes 500 to 1,200 gallons per minute, of strongly acid water, requiring pumps of composition metal, with lead or wood-lined pipes. The new pumps have a combined capacity of 5,000 gallons per minute, and the water, after forked from the mine, is leached over scrap-iron, producing cement copper to the value of about $5,000 monthy. The old waste-dumps contain about 250,000 tons of rejected material, averaging circa 2% copper. Considerable ore has been blocked out in open-cuts, for stoping, this averaging about 4% copper, and the tenor can be improved by hand-sorting.

A 200-ton smelter is located at Punta Sal, on Santiago harbor, 9 miles from the mine, and connected therewith by El Cobre railroad, 9 miles in length, with termini at Punta Sal and at the mine. This railroad, owned by the company, has 2 locomotives and 40 cars. Fuel used at the mine is bituminous coal, costing $4.35 per ton, and the smelter is planned to use coke, costing $6.50 per ton. Late in 1905 the property was said to be shipping 10,000 tons of ore monthly, but the management, formerly quite communicative, has become very reticent, and will give out no returns of operations, which leads to the suspicion that all may not be going as favorably as had been planned.

EL COBRE MINING CO. **MEXICO.**

Office: 248 Equitable Bldg., Denver, Colo. Mine office: Hermosillo, Sonora, Mex. Joseph D. Whitham, president and treasurer; A. S. Mackenzie, vice-president and general manager; Guy C. Clemens, secretary. Organized under laws of District of Columbia, with capitalization $5,000,000, shares $1 par. Lands, circa 1,000 acres, including La Gran Duquesa and Transvaal mines, also a smelter site, in the Ures district, about 60 miles east of Hermosillo, Sonora, Mexico, to which point there is a good wagon road. Ores are claimed to have given average smelter returns of 20.1% copper, 1.75 oz. silver and $4 gold per ton. The company's fiscal agent, F. A. Wright,

of Chicago, advertised, October, 1904, that it was estimated by experts that on less than 50 acres of this ground the first ten feet in depth would give more than 500,000 tons of gold-copper ore that, when smelted, would yield a net profit of over $10,000,000. The property may be all that could be desired, but such abominable lies necessarily place both management and property under suspicion.

EL DIAZ GOLD & COPPER CO. **MEXICO.**

Letter returned unclaimed from former office, 332 Drexel Bldg., Philadelphia, Pa. Mine office: San Martin Hidalgo, Jalisco, Mexico. Daniel Lamont, Jr., president and trustee; Aubrey F. Lee, secretary; J. R. Williams, manager. Organized 1901, under laws of New Jersey, with capitalization $1,600,000, shares $1 par. Lands, 60 pertenencias, area circa 410 acres, including 12 old workings, in the Rancho de Papinto district of Jalisco. Mine is opened by tunnels and shafts. Equipment includes a 10-stamp mill, 25-ton chlorination plant and an 80-ton smelter.

ELDORA ENTERPRISE GOLD MINING CO. **COLORADO.**

Mine office: Eldora, Gilpin Co., Col. Chas. W. Sheehan, superintendent, at last accounts. Ores carry gold, silver and copper. Has steam power and a 10-ton smelter.

EL DORADO COPPER MINING CO. **CALIFORNIA.**

Succeeded, circa 1906, by Woodside-Eureka Mining Co.

ELDORADO GOLD MINING & MILLING CO. **UTAH.**

Office: 549 25th St., Ogden, Utah. Mine office: Hot Springs, Box Elder Co. Utah. Don Maguire, manager. Ores carry silver, lead and copper. Presumably idle.

ELECTRA MINING & MILLING CO. **ARIZONA.**

Office: care of Alfred Day, fiscal agent, P. O. Box 513, Steubenville, Ohio. Lands, somewhere in Arizona, are claimed to show ore giving average assays of $27 per ton.

ELECTRIC IRON & STEEL CO. **CALIFORNIA.**

A fraud, perpetrated by W. C. Brunson and J. W. Turner, who falsely claimed to own 7,000 acres of rich mining land, in Shasta county, California.

ELECTROLYTIC COPPER MINING & SMELTING CO. **OREGON.**

Letter returned unclaimed from former mine office, Imnaha, Oregon.

EL FAVOR MINING CO. **MEXICO.**

Office: San Diego, Cal. Mine office: Hostotipaquillo, Jalisco, Mexico. Lands, 10 pertenencias, lying circa 15 miles northwest of Hostotipaquillo, carrying 4 parallel veins of 4 to 10 metres width, opened by several old shafts and tunnels, and showing cupriferous silver-lead ores.

EL GLOBO MINING & MILLING CO. **MEXICO.**

Office: care of Dr. G. W. Orr, Lake Linden, Mich. Organized 1905, under laws of Arizona, with capitalization $400,000, shares $100 par. Lands, sundry claims in Sonora, Mexico, lying circa 70 miles south of Douglas, Arizona.

ELITE GOLD & COPPER MINING CO. **WASHINGTON.**

Dead. Gave deed to property, November 21, 1904.

KUPFERERZBERGWERK ELIZA. **GERMANY.**

Mine office: Mallau, Elsass-Lothringen, Germany. Idle.

ELIZABETH COPPER CO.

Office: 43 Exchange Place, New York. Mine office: South Strafford, Orange Co., Vermont. August Heckscher, president; F. A. Berthold, secretary and treasurer; John N. Judson, general manager; James W. Tyson, Jr., mine superintendent; J. J. Morrison, mill superintendent. Organized, 1905, under laws of New Jersey. Property is the old Elizabeth mine, opened 1793, for magnetic pyrites, used in making copperas. It being found, eventually, that the mine carried an average of about 3% copper, in the form of chalcopyrite, disseminated in pyrrhotite, the Elizabeth became the largest American copper producer, previous to the opening of the rich mines of Lake Superior. Ore bodies occur as lenses, in foliated micaceous schists, the lenses overlapping and wedging out at bottom. Main ore body at the Elizabeth has been mined for 700′ in length, and at one point was 100′ wide. Main tunnel is 1,340′ long, and mine is estimated, by present management, to have about 300,000 tons of ore in sight. Equipment includes a steam plant and small smelter, also a concentrator using the Rowand magnetic separation process. Nearest railroad, 8 miles, is the Boston & Maine. Operations were resumed March, 1906, under present management.

ELIZABETH MINING CO. **VERMONT.**

Succeeded, 1905, by Elizabeth Copper Co.

ELK MOUNTAIN MINING & MILLING CO. **WYOMING.**

Office and mine: Encampment, Carbon Co., Wyo. T. R. Smith, president; S. E. Phelps, secretary and treasurer; B. A. Kaylor, superintendent. Organized 1900, under laws of Wyoming, with capitalization $1,000,000, shares $1 par. Lands, 660 acres, patented, in the Upper Platte district, showing three 5′ ore bodies, in limestone, giving assays of 15% copper and $3 gold per ton, from chalcocite, bornite and chalcopyrite. Has 3 shafts, deepest 183′, and an 85′ tunnel, with steam and electric power. Idle.

ELLA COPPER MINING & DEVELOPMENT CO. **CALIFORNIA.**

Letter returned unclaimed from former office, San José, Cal. Lands, near the New Almaden cinnabar mine, are claimed to show a 40-vein of 10% copper ore, which is too good to be true.

ELLA MINE. **WASHINGTON.**

Lands, 10 claims, on the north slope of Mt. Ellemeham, Okanogan Co., Washington, showing 5 veins of 3′ to 5′ width, opened by sundry shallow shafts, short tunnels and open-cuts, showing ore giving assays of $10 to $33 per ton, in copper, lead, silver and gold.

ELLAMAR MINING CO. **ALASKA.**

Office: Ellamar, Prince of Wales Island, Alaska. This mine was the first copper producer in Alaska, beginning production circa 1901. Ore is shipped for smelting both to Tacoma and to the Alaska Smelting & Refining Company's smelter at Hadley, Prince of Wales Island. Mine is close

to the sea, hence ore shipments are made with comparative cheapness. Production, 1905, was about 20,000 tons of 10% ore, giving a net production of circa 2,000,000 pounds fine copper.

EL MAJIN COPPER CO. **MEXICO.**

Letter returned unclaimed from former office, Hermosillo, Sonora, Mexico, with notation, "unknown."

ELM RIVER COPPER CO. **MICHIGAN.**

Office: 60 State St., Boston, Mass. Mine office: Winona, Houghton Co., Mich. H. F. Fay, president; Geo. G. Endicott, secretary and treasurer; preceding officers, John C. Watson, Stephen R. Dow and Chas. H. King, directors; Jas. Chynoweth, superintendent; A. D. Nicholas, purchasing agent; Old Colony Trust Co., Boston, registrar. Organized April 20, 1899, under laws of New Jersey, with capitalization $1,200,000, shares $12 par, fully paid. Annual meeting, third Wednesday in April, at Jersey City, New Jersey. Expended $44,266.06 in 1905, ending the year with a balance of $155,088.85.

Official returns to the state of Michigan, as of date January 1, 1905, disclose the following figures:

Amount of cash paid in on capital stock	$1,200,000.00
Entire amount invested in real estate	626,411.99
Amount of personal estate	211,514.70
Amount of floating debt	2,490.62
Amount due company	2,333.80

Lands, 2,300 acres, in Section 6, Town 52 North, Range 35 West, Sections 1, 2, 11 and 12, Town 52 North, Range 36 West, and Section 36, Town 53 North, Range 36 West, also a millsite in Section 30, Town 54 North, Range 36 West, on the shore of Lake Superior. Nearly a complete cross-section of the Elm River tract has been secured by 5,000′ of diamond drill borings, and considerable sinking and drifting has been done, on several cupriferous amygdaloids, at different points. Shafts No. 1 and No. 2, latter 200′ deep, are on the Winona lode; No. 3 shaft, 100′ deep, and No. 4 shaft, 50′ deep, are on the Shawmut lode, and No. 5 is on an unidentified lode located by diamond drill. No. 1, the first shaft started by the company, was abandoned at depth of 100′, but was reopened, 1903, owing to the improved showing secured at the Winona. Shaft is 9x14′ in size, and is 800′ in depth, sunk in the foot-wall of the Winona amygdaloid, at an angle of 72°. Crosscuts and drifts on the 500′ level, 1904, showed a 35′ amygdaloid, carrying copper in unpayable quantities. On the 800′ level, drifts both north and south show a healthy amygdaloid of 12′ to 16′ width, but no profitable ground has been opened as yet. In crosscutting west from the Winona lode, 12 other cupriferous amygdaloidal beds were cut, but none were found of commercial value. Shaft has a duplex hoist, good for 1,000′ depth, also 2 Burt marine boilers and a 4-drill air-compressor. Water is pumped from a dam by a Blake pump. Property has a 40x40′ machine shop and smithy, 40x40′ carpenter shop, 28x65′ two-story warehouse, boarding-house with accommodations for 100 men, a schoolhouse

and a number of dwellings. Work is to be continued until the company makes a mine or uses up its resources, which is the correct policy to pursue, all other opinions to the contrary notwithstanding.

EL PROGRESO COPPER MINING CO. **MEXICO.**

Out of business, stockholders having been given shares of Imperial Corona Gold Mining Co. in exchange.

EL REY GOLD & COPPER MINING CO. **WYOMING.**

Succeeded, circa 1904, by Consolidated Gold, Copper & Coal Co.

ELSIE ADAIR COPPER MINING CO. **AUSTRALIA.**

Office: Port Augusta, South Australia. A. M. Hardy, manager. Has steam power and employed about 40 men, at last accounts.

EL SUEÑO MINING CO. **MEXICO.**

This company, having lands somewhere in the northern district of Baja California, Mexico, has a small smelter, known as El Cueras de Venado, and made 69 kgs. of copper in 1903.

ELSIE MINING CO. **COLORADO.**

Has gone out of business at Winfield, Chaffee county, Colorado.

EL TRIUNFO CONSOLIDATED MINING CO. **MEXICO.**

Office: 52 West 45th St., New York. Letter returned unclaimed from alleged mine office, Bacoachi, Sonora, Mexico, with notation that no such company is in existence at that point, notwithstanding claims of the company, made at the same date, that it had in operation 3 mines near Bacoachi. A. C. Charlot, president; B. Granville, managing director. Organized under laws of Delaware, with capitalization $2,000,000, shares $1 par. Company bears every indication of being a stock-jobbing scheme for separating fools from their money.

EL VERDE GRANDE COPPER CO. **MEXICO.**

Office: care of Percy Sharpe, Nogales, Arizona. Letter returned unclaimed from former mine office, Imuris, Magdalena, Sonora, Mexico. Capitalization $2,000,000, shares $1 par. Lands are in the foothills of the Sierra Azul, 14 miles from Imuris, which is on the Sonora railroad.

ELY CENTRAL COPPER CO. **NEVADA.**

Office: 351–139 South 4th St., Philadelphia, Pa. Mine office: Ely, White Pine Co., Nevada. O. A. Turner, president; B. A. Hazell, vice-president; Leon Hampton, secretary; John W. Woodside, treasurer; Fred. S. Pheby, general manager. Organized April, 1906, under laws of Delaware, with capitalization $12,000,000 shares $1 par; issued, $10,200,000. Trust Company of North America, Philadelphia, registrar. Lands, 470 acres, unpatented, in the Robinson district, showing limestone country rock carrying a mineralized dike of monzonite, containing estimated average values of 3% copper, 1 oz. silver and 40 cents gold per ton, the ore being distributed through a porphyritic dike of 3,000′ estimated width. Ores are malachite near surface and chalcopyrite at a little depth. Has 250′ of underground openings. Management expects to get railroad connections at Ely, during 1906. Plan of development includes prospecting with diamond drills, sinking a working shaft, and eventually building a 2,000-ton concentrator.

ELY MINE. VI

Now known as the Copperfield Mines.

ELY MINING & MILLING CO. I

Office: care of Maj. H. P. Myton, president, Salt Lake Ci Mine office: Ely, White Pine Co., Nev. J. W. Langley, secretary. C 1904, under laws of Utah.

EMERALD MINE. WI

Office: care of H. A. Robinson, Wheatland, Wyo.

EMERALD MINING & SMELTING CO. I

Mine office: Santa Catarina del Norte, Baja California, Mexico. Ramsdell, superintendent. Property is La Esmeralda coppe opened by shafts.

SOCIEDAD MINERA EMMA LUISA.

Mine office: Taltal, Antofagasta, Chile. J. S. Marion, supe ent, at last accounts. Has auriferous copper ores, with steam po

EMMA MINE. BRITISH COL

Mine office: Eholt, Yale district, B. C. The British Columbia Co., Ltd., owns three-fourths and the Hall Mining & Smelting C owns one-fourth of this property.

EMMA MINE. MO

Held by Butte Copper & Zinc Co.

GEWERKSCHAFT EMMANUEL. GE

Mine office: Wülfrath, Rheinprovinz, Germany. Has a sing developing zinc and copper ores.

EMMONS MINE. NORTH CAI

Owned by Hercules Gold & Copper Co.

EMPIRE COPPER CO. I

Dead. Lands now held by Pacific Consolidated Mining Co.

EMPIRE COPPER & GOLD MINING CO. AI

Office: 122 West Third St., Los Angeles, Cal. Mine office: Cochise Co., Arizona. Employs 11 men. J. L. Brooks, president eral manager; M. J. Gress, vice-president; H. H. Morrow, secret treasurer: preceding officers, J. O. Pace, H. Hermanson, Angus Gra M. M. Gustin, directors. Organized January 31, 1905, under Arizona, with capitalization $1,500,000, shares $1 par. Annual second Monday in January. Lands, 15 claims, area 300 acres, from Johnson, near the Copper Chief property, in the Little Dragoo tains. Lands show a good iron capping, carrying a little carbo Development is by shafts of 25′ and 60′, and by tunnels of 50′, 3 340′, showing ore giving average assays of 17% copper. 4 oz. sil $2.80 gold per ton. Company plans continuous development, 1906.

EMPIRE-GOLD BUG MINING CO. COL

Mine office: Empire, Clear Creek Co., Colo. W. P. Clough, intendent, at last accounts. Has auriferous and argentiferous ores.

EMPIRE MINE. **ARIZONA.**

Mine office: Lochiel, Santa Cruz Co., Ariz. Stephen O'Connor, owner. Ores carry copper, silver and lead. Idle at last accounts.

EMPIRE MINES CO. **NEW MEXICO.**

Mine office: Hanover, Donna Ana Co., N. M. J. W. Bible, superintendent. Property is the Ivanhoe mine, considerably developed, on a promising ore body. Has steam power and a 100-ton concentrator. Idle.

EMPIRE MINING CO. **ARIZONA.**

Office: care of H. B. Coon, secretary, Utica, N. Y. Mine office: Bisbee, Cochise Co., Ariz. W. L. Scott, president; J. G. Pritchard, resident director; A. W. Daggett, treasurer; Alex. Erickson, superintendent. Organized June 27, 1904, under laws of Arizona, with capitalization $1,000,000, shares $1 par. Lands, 10 claims, area 200 acres, near the Modern mine, opened by a 350′ tunnel, claimed to show a 5′ vein of auriferous and argentiferous copper ore, carrying $14 values per ton in a crosscut. Ore is found in small stringers, typical of this district. Was developing with one shift, March, 1906.

EMPIRE MINING CO. **MICHIGAN.**

Dead. Lands, in Keweenaw county, Michigan, sold, 1905, to Keweenaw Copper Co.

EMPIRE MINING CO. **MICHIGAN.**

Wound up, 1901. Lands were in Ontanagon county, Michigan.

EMPIRE SMELTING CO. **ARIZONA.**

Succeeded, circa 1905, by Southwestern Smelting & Refining Co.

EMPIRE & STAR MINING, MILLING & SMELTING CO. **WYOMING.**

Dead. Succeeded by Hecla Mining Co.

EMPIRE TUNNEL & GOLD MINING, MILLING & TRANSPORTATION CO. **COLORADO.**

Office: Georgetown, Colo. Mine offices: Empire, Clear Creek Co., Colorado, and Leadville, Lake Co., Colorado. Frank A. Maxwell, president and manager; Clarence Jarbeau, secretary; Daniel Wall, superintendent at Empire; W. S. Jones, superintendent at Leadville. Property includes the Empire tunnel and gold mines, at Empire, and the Cloud City mine, at Leadville, carrying gold, silver, lead and copper ores, latter as sulphides. Has water power at Empire, and steam power at Leadville. Has a 50-ton concentrator, and employs circa 50 men.

ENCAMPMENT MINING CO. **WYOMING.**

Dead. Lost lands in 1903.

ENCINITAS COPPER & SMELTING CO. **CALIFORNIA.**

Mine office: Encinitas, San Diego Co., Cal. J. Andrew Wauchope, superintendent. Is supposed to have a concentrator. Was working in a small way, May, 1905.

ENCINITO COPPER CO. **CALIFORNIA.**

Dead. Succeeded, circa 1905, by Encinitas Copper & Smelting Co.

ENGELS COPPER MINING CO. **CALIFORNIA.**

Office: 421 Market St., San Francisco, Cal. Mine office: Taylor

ville, Plumas Co., Cal. Has sulphide, carbonate and silicate ores, slightly developed, giving good assay values in copper, gold and silver.

ENGLISH & AUSTRALIAN COPPER CO., LTD. **AUSTRALIA.**

Office: 102, Palmerston House, London, E. C., Eng. Works offices: Port Adelaide, South Australia, and Newcastle, New South Wales, Australia. John Harvey, chairman; Wm. Owen Robinson deputy-chairman; W. R. Caldwell-Moore, secretary; F. S. Chany, general manager; F. Cash, smelter superintendent. Organized 1851, capitalization reduced to £150,000, shares 30s. par; issued £102,988. Debentures, £31,050 outstanding, at 6%. Paid dividends of 54%, 1871–1873; last dividend, 1s., 1904. Property includes smelting works at Newcastle and Port Adelaide, the two plants employing 100 men, also an interest of 3,904 shares in the Clara St. Dora Copper Mining Co.

ENTERPRISE MILL & MINING CO. **COLORADO.**

Mine office: Eldora, Gilpin Co., Colo. J. T. Mitchell, manager. Has cupriferous and gold silver ores, with steam power, concentrator and 50-ton chlorination plant, employing about 25 men, at last accounts.

ENTERPRISE MINE. **ARIZONA.**

Mine office: Kingman, Mohave Co. Ariz. Lands, sundry claims in the Wallapai Mountains, about 17 miles east of Kingman, opened by a 200′ shaft, said to show a big body of argentiferous and auriferous copper ore.

ENTERPRISE MINING & MILLING CO. **NEW MEXICO.**

Office: care of W. B. De Shon, secretary and treasurer, Pittsburg, Pa. Mine office: Cooney, Socorro Co., N. M. Geo. A. Freeman, vice-president and general manager. Lands, 2 claims, opened by a 130′ shaft, showing a 4′ ore body, which has given assays of $40 per ton, and a shaft of 200′, said to be bottomed in a 10′ vein. Values are principally gold. A new stamp-mill and concentrator are being built, with a concentrating capacity of 25 tons and stamping capacity of 8 tons daily. Has a 150-light electric plant.

EQUATOR MINING & SMELTING CO. **ARIZONA.**

Office: 49 Wall St., New York. Mine office: Jerome, Yavapai Co., Ariz. Senator Wm. A. Clark, president; James A. McDonald, vice-president; Pierre V. C. Miller, secretary and treasurer; preceding officers, Chas. W. Clark and J. H. Anderson, directors. Organized March 19, 1900, under laws of West Virginia, with capitalization $500,000, shares $1 par.

Property, commonly known as the Iron King mine, is on Equator Hill in the Agua Fria district, south of Jerome 4 miles by trail or 6 by wagon-road, and transportation from and to Jerome is by wagon. The property shows a mineralized zone ranging up to 600′ in width, and traceable for upwards of 1,000′ in a north and south direction. It was feared that the ore body was a blanket vein, but diamond drill borings show that it holds to depth, carrying auriferous and argentiferous copper ores of good grade. Mine is developed by a 300′ main shaft, and is equipped with a substantial machinery plant. A 5,000′ gravity tram-line connects the portal of the

upper tunnel with the roast-yard of the reduction plant. The smelter is rated at 250 tons daily capacity. Production was circa 800,000 lbs. fine copper, 1904, but mine and smelter were idle at last accounts. Management is good and property is generally considered valuable, though it has as yet failed to redeem the promise of its earlier stages.

ERIE CONSOLIDATED MINING & REDUCTION CO.

Dead. Name changed from Wahnita Copper Co. Both fraudulent.

ERIE COPPER MINING CO. **UTAH.**

Office: 4 Atlas Blk., Salt Lake City, Utah. Letter returned unclaimed from former mine office, Milford, Beaver Co., Utah. C. E. Albrook, president; L. G. Brown, secretary and general manager. Organized 1902, under laws of Utah, with capitalization $1,500,000, shares $1 par. Lands 15 claims, in the Beaver Lake district, showing fissure veins in granite, one of which, supposedly an extension of the O. K. of the Majestic, is developed by a 312′ two-compartment shaft, showing oxidized ores at and near surface, with low-grade sulphides carrying occasional native copper in the lower workings. Has gasoline power.

ERIEGA COPPER & COAL MINING & SMELTING CO. **MONTANA.**

Office: care of John F. Firch, president, Butte, Mont. Chas. Anceny, vice-president. Organized 1901, under laws of Montana, with capitalization $1,000,000. Lands, 9 patented claims, area 185 acres, also 960 acres of coal lands, a 20-acre millsite and a 20-acre smelter-site, in the Bozeman district of Gallatin county, Montana, showing 2 fissure veins, averaging 30′ width, claimed to give average values of 7 % copper, 30 oz. silver and $10 gold per ton, mainly from sulphide ores, with occasional carbonates and native copper. Has shafts of 25′, 40′ and 80′, and tunnels of 60′ and 300′. Property apparently is of promise, but the officers of the company have poor standing, and company, being out of cash and credit, is moribund.

ERIE-ONTARIO DEVELOPMENT CO. **MICHIGAN.**

Office: 60 State St., Boston, Mass. Mine office: care of Jas. Chynoweth, superintendent, Calumet, Houghton Co., Mich. H. F. Fay, president; Geo. G. Endicott, vice-president. Organized 1905, with capitalization $50,000, shares $10 par, fully paid.

Property, held under option, extended until Jan. 1, 1907, is 610 acres, including the old Erie and Ontario mines, in Sections 29, 30, 31 and 32, Town 53 North, Range 35 West, 7 miles south of the Champion and just midway between the Champion and Winona mines. The tract shows a copper-bearing lode, apparently the southerly continuation of the Baltic amygdaloid. The Erie and Ontario were worked in a small way, under great difficulties, circa 1855-1858, the only communication with the balance of the district being by a 10-mile wagon-road to Misery Bay, thence, from that miserable harbor, by water. Development was by shallow pits, from which some mass and barrel copper was taken. Work was begun, 1905, by present management, and in April, 1906, a shaft was down 142′, and it was planned to crosscut at a depth of 200′ or 300′. The shaft, sunk at 68°, runs into the

hanging wall. Lode is about 25′ in width, being a healthy amygdaloid, carrying considerable epidote, but little copper. Conditions seem much similar to those at the Challenge mine, which is the nearest neighbor to the north. Machinery plant includes a 500′ hoist and 4-drill air-compressor.

ERO COPPER CO.

Organized April, 1905, under laws of Maine.

COMPAÑIA MINERA ESCUADRA, S. A. **MEXICO.**

Mine office: Ocotlán, Oaxaca, Mexico. W. J. Carter, manager; E. G. Hart, superintendent. Ores carry gold, silver and copper. Mine is opened by tunnels and equipped with steam power.

ESCURIAL COPPER MINES, LTD. **SPAIN.**

Offices: 4, Union Court, London, E. C., Eng., and Pelayo, 2, Barcelona, Spain. Mine office, Calmenarijos, Madrid, Spain. Jas. Taylor, chairman; Joaquin Lorena, mine manager; H. Gardiner, secretary. Organized Oct. 17, 1901, with capitalization £125,000, shares $1 par; issued, £109,177. Lands, 342 acres, held under perpetual lease from the Spanish Government, including the Gloria, Ramón, Jaime and Nuestra Señora del Pilar mines. Work is confined to the latter, which shows 8 ore bodies and was worked by the ancients, either Romans or those who preceded them, to a depth of 135′, by 3 shafts, with several drifts. Sundry small shipments of selected ore have given returns of 7.73% to 20.36% copper. Property considered promising.

ESMERALDA COPPER PRECIPITATING CO. **ARIZONA.**

Office: 54 La Salle St., Chicago, Ills. Mine office: Ryan, Coconino Co., Arizona, via Kanab, Utah. Employs 16 men. R. H. Salter, president; Nicholas Noesges, secretary; Robt. Maney, treasurer; C. F. Drake, superintendent. Organized 1904, under laws of Arizona, with capitalization $5,000,000, shares $1 par. Property is the mines and works of the Coconino Copper Co., held under lease, and which it is planned to make a producer, by use of the Neill leaching process.

ESMERALDA MINE. **MEXICO.**

A company by this name, organized by W. R. Ramsdell, et al, began mining, 1900, in Baja California, Mexico, doing considerable work and shipping some ore, but veins pinched and grew low-grade, copper dropped in price, and work was suspended, circa 1902.

MINA ESMERALDA. **MEXICO.**

Mine office: Cos, Sonora, Mex. Chas. Scott, superintendent, at last accounts. Lands, sundry claims, 18 miles east of Cos, carrying gold-copper ores. Presumably idle.

MINAS LA ESMERALDA y ANEXAS. **MEXICO.**

Mine office: Chalchihuites, Zacatecas, Mexico. Leopoldo Viadero, manager. Ores carry gold, silver, lead and copper. Mine is opened by shafts and tunnels, and employed about 150 men, at last accounts.

ESNA DEVELOPMENT SYNDICATE, LTD. **NORWAY.**

Organized, 1896, to take over a Norwegian mine, since abandoned.

SOCIEDAD MINERA ESPAÑOLA DEL NORTE DE ESPAÑA. **SPAIN.**

Mine office: Herrera de Rio Pisuerga, Palencia, Spain. Don Federico Villanueva, president. Organized 1902. Lands include various concessions carrying coal, iron and copper.

SOCIEDAD ESPAÑOLA DE FUNDICIÓN. **CHILE.**

Operates Los Anjeles mine, in the department of La Ligua, Chile, and is said to make matte equivalent to circa 650,000 lbs. fine copper yearly.

COMPAÑIA MINERA ESPERANZA y CONSTANCIA. **MEXICO.**

Mine office: Sierra Mojada, Coahuila, Mexico. Miguel Bernardino, manager. Operates La Fortuna mine, opened by a 350′ shaft, equipped with steam power and producing silver, lead and copper. Employed circa 200 men, at last accounts.

ESPERANZA COPPER & SULPHUR CO., LTD. **SPAIN.**

Offices 74, Palmerston House, Old Broad St., London, E. C., Eng. Organized February 14, 1906, with capitalization £350,000, shares £1 par, to take over the Esperanza group, in the province of Huelva, Spain, from the Española Copper Syndicate, Ltd.

ESPERANZA MINING CO.. **MEXICO.**

Office: care of W. R. Nicholson, president, Land Title Bldg., Philadelphia, Pa. Mine office: Isla de Cedros, Baja California, Mexico. Employs 20 men. Geo. P. Brown, general manager; Harold Playter, superintendent; D. A. Conolly, smelter superintendent. Lands, 83 pertenencias, also 40 acres miscellaneous lands, on Cedros Island, in the Gulf of California. Country rock is diorite, showing 3 lenticular ore bodies, carrying carbonate and sulphide ores, estimated by company to average 40′ width, 300′ depth and 1,100′ length, and to contain an average of 2.5% copper, 3% zinc, 2 oz. silver and $3.50 gold per ton. Mine has been extensively developed, having about 8,500′ of workings, showing circa 150,000 tons of low-grade ore, with about 100,000 tons blocked out for stoping. Property was opened 1891, closed 1901, reopened 1905. Surface gold ores change to basic copper ores at depth. Property has produced about $450,000 in values, from shipment of high-grade ores to smelters at Denver, Pueblo, San Francisco and Tacoma. The great bulk of the ores being too low in grade to permit shipment for smelting, a reduction plant has been started at the mine. This will have a 50-ton blast-furnace, planned to turn out matte carrying 16% copper, 6 oz. silver and 1.5 oz. gold, to be sent to the Tacoma smelter for refining. Fuel at smelter is coke, costing $18 per ton. Production, 1905, was circa 275,000 lbs. fine copper.

MINAS ESPERANZA y VISITACION. **SPAIN.**

Mine office: Albarracín, Teruel, Spain. D. Santiago Maorad, owner. Property is sundry iron mining lands, on which a promising lense of copper ore was discovered, 1903.

ESPIE BAY MINES DEVELOPMENT SYNDICATE, LTD. **TURKEY IN ASIA.**

Voluntarily wound up, June, 1904.

JOSÉ R. ESPINOZA. **CHILE.**

Office: Petorca, Aconcagua, Chile. Operates Las Palmas mine, opened 1880, making 100 to 150 tons copper yearly, also the Cantarito mine, opened 1898, making 50 tons of copper annually, both in the department of Petorca.

ALEXANDER ESQUER y CA. **MEXICO.**

Mine office: Baroyeca, Sonora, Mex. J. J. Esquer, manager. Operate the Mexicana, Esperanza and other mines, having ores carrying copper, gold and silver, opened by shafts and tunnels.

ESSEX COPPER CO. **MICHIGAN.**

Office: care of Marmaduke Richardson, president, 12 John St., New York. Alfred Meads, agent. Lands, in Ontonagon county, Michigan, have been sold, and company is being liquidated. Has paid $1 per share, 1906, and a further dividend will be paid.

MINA ESTACA. **CHILE.**

Mine office: Chañaral, Atacama, Chile. Cruz Hermanos, owners; R. Cruz, manager. Has steam power and employs about 50 men.

ESTERBROOK MINING CO. **WYOMING.**

Office and mine: Douglas, Converse Co., Wyo. Geo. W. Metcalf, president; John Foxton, secretary and treasurer. Organized 1897, under laws of Wyoming, with capitalization $10,000; reorganized Sept. 9, 1903, with capitalization $1,000,000; issued, $490,000. Lands, 120 acres, also 120 acres miscellaneous lands, in Albany county, Wyoming, about 40 miles south of Douglas, showing a 4′ fissure vein, in country rocks of diorite, schist and granite, giving assays of 2% to 4% copper, 25% to 30% lead, 2 oz. to 4 oz. silver and $1 to $2 gold per ton, from cerussite, galena, cuprite, chalcopyrite and native copper. Has 2 short tunnels and 5 shafts, deepest 284′. Company plans improving an available water power, and constructing a 100-ton concentrator.

ESTEY MINING & MILLING CO. **NEW MEXICO.**

Succeeded, circa 1902, by Dividend Mining & Milling Co.

COMPAGNIE LA ESTRELLA. **SPAIN.**

Office: Blvd. Haussmann, 16, Paris, France. Lands, sundry copper properties, in the province of Almeria, Spain. Presumably idle.

NUEVA SOCIEDAD PROPRIETARIA LA ESTRELLA. **SPAIN.**

Office: Granada, Spain. Property is La Jerezana mine, in the province of Granada, Spain. Presumably idle.

ESTRELLA MINING CO. **UTAH.**

Mine office: Milford, Beaver Co., Utah. S. A. Turbet, superintendent. Lands, sundry claims, lying southwest of Milford, opened by a shaft said to be of 400′ depth.

ETHEL CONSOLIDATED MINES CO. **WASHINGTON.**

Office and mine: Index, Snohomish Co., Wash. Geo. A. Pounder, president and general manager, at last accounts. Organized 1902, with capitalization $3,500,000, shares $1 par, succeeding the Ethel Copper Mining Co. and John D. Copper Co. Lands, 37 contiguous claims, carrying 21,000′ of the strike of the vein. Principal development is on

the Ethel group, opened by a 2,000′ tunnel, showing a considerable body of low-grade ore, carrying oxidized ores, bornite and chalcopyrite, with quartz gangue, claimed to average 4% copper, with small gold and silver values. Has a Pelton water-wheel and 75-ton concentrator, latter, connected with mine by a 4,000′ gravity tram, having a crusher, rolls and Huntington mill. Ores slime badly in concentration. Company began the payment of 1% monthly dividends in 1903, and mine was shut down shortly thereafter, Property is under option to McAllister-Rowland Copper Mining Co.

ETHEL COPPER MINING CO. **WASHINGTON.**

Succeeded, 1902, by Ethel Consolidated Mines Co.

ETHEL GOLD MINING CO. **COLORADO.**

Office and mine: Turret, Chaffee Co., Colo. L. L. Miller, president; A. A. McKenzie, vice-president and superintendent: A. O. Olson, secretary. Organized May 20, 1901, with capitalization $300,000, shares $1 par. Lands are sundry gold claims in the Cripple Creek district, lead and silver claims in the Elk Mountain district, and copper, gold and graphite claims in the Turret Mountain district of Chaffee county, Colorado. Presumably idle.

ETNA MINING CO. **COLORADO.**

Mine office: Georgetown, Clear Creek Co., Colo. W. D. Hoover, manager. Has a tunnel, showing ores carrying gold, silver, lead and copper.

ETRUSCAN COPPER ESTATES, LTD. **ITALY.**

Offices: 139, Queen Victoria St., London, E. C., Eng. Mine office: Campiglia Marittima, Tuscany, Italy. Vavasour Earle, chairman; Alex. Hill & Stewart, mine managers; George Pepper, auditor; Henry Pope, secretary; Organized December, 1900, and reconstructed December 7, 1904, with capitalization £575,000, shares £1 par. Debentures, £200,000, at 6%, redeemable at 105, March, 1912.

Lands, 2,600 acres, of which 2,000 are freehold and balance held under perpetual mining rights, the property including the old Lanzi, Temporino and Rombola mines. These properties show numerous and extensive old workings, certainly as ancient as the Roman era, and probably dating back to Etruscan times. During the Nineteenth Century various Italian, French and English parties attempted, successively but unsuccessfully, to reopen these old mines, which are honeycombed by ancient inclines, adits, drifts, winzes and stopes. The properties were examined by C. Algernon Moreing, Edgar P. Rathbone, R. J. Frecheville, Alexander Hill and J. H. Fawcett. The three first named, who are eminent engineers of the highest professional standing, reported unfavorably. Mr. Moreing states that "the fact is, that poor as the showing is at the lead and blende mines, it is the only place where ore can be seen at all." Mr. Moreing later said that the official statements of the company to the shareholders, referring to colossal ore deposits, were absolutely incorrect, and that there are no such deposits in existence. For these statements the company sued Bewick, Moreing & Co., but dropped the suit, for reasons best known to the management

Mr. Rathbone said, "I do not consider that it would be possible to adopt any systematic method of mining which would pay expenses." Mr. Hill, also an eminent authority, says that the mine "possibly" might pay, with proper development. Mr. Fawcett thought enough of the showing to accept the management of the mine, but had the good sense to resign later, and recovered damages of £250 from Mr. Earle, for slander. Mr. Earle considers all experts incompetent, his own education, as a manufacturer of cement, having been peculiarly fitting for training the head of a copper mining company. The company claims to have 4 cupriferous veins, ranging 60′ to 120′ in width, nearly parallel and traceable 1½ miles. Concensus of the best professional opinion is to the effect that the ore bodies, while undoubtedly extensive, are pockety and uncertain, and it is apparent that the principal values were removed by the ancients.

Development by the present company has been carried on at various points. The Walter vertical shaft, of 75 metres depth, at the Cava del Piombo mine, has opened several levels, stated to show a vein of 20x15 metres, in a section on the third level. This shaft has a 13-metre head-gear, with a two-cylinder hoist and three boilers. The Grand Cava shaft shows extensive old workings, as, for that matter, do practically all of the new openings. Operations have been suspended on the West vein. The Govett shaft, of 100 metres depth, shows extensive old workings, and little else. The Earle shaft, formerly the Coquand, 90 metres in depth, also shows many old workings. Le Marchant shaft, of 30 metres depth, with an 18-metre drift, shows heavy iron pyrites and a little chalcopyrite, with amphibole gangue. While the property is called a copper mine, it seems to be the practically unanimous opinion of experienced engineers, not connected with the company, that the principal values, doubtful as those may be, are in lead and zinc, rather than in copper.

The smelter, at Rombola, is connected by rail with the mines at Lanzi and Temporino. The reduction plant includes a concentrator and smelter, latter having a copper furnace of 100 tons nominal daily capacity.

In 1905, the management, having followed a consistent course of utter incompetency, engaged Alex. Hill to examine the mine, despite the contumely with which his report had been received three years previously. Mr. Hill's second report was identical with the first, with the addition of sensible advice for the salvage of the sadly mismanaged property. The management, being in a chastened frame of mind, seems inclined to do as Mr. Hill advises. The puttering smelting operations have been dropped, as only 625 tons fine copper were secured in all, and diamond drilling has been started. Despite claims of the management that the ore returned 2.68% copper, analysis of the figures shows returns of but 1.5%.

The Etruscan Copper Estates afford an unusually perfect specimen of bad management. The personal probity of Mr. Earle and his associates is not questioned, and they have squandered their own money as lavishly as that of the other shareholders, but the management, until finally humbled by the utter failure of its plans and promises, was phenomenally

arbitrary and ignorant. Under the competent management of Messrs. Alex. Hill & Stewart—if they are permitted to remain in charge—there is what may be termed a fighting chance, for the discovery and development of new ore bodies of payable quantity and quality.

EUCLID DEVELOPMENT CO. **ARIZONA.**

Mine office: Benson, Cochise Co., Ariz. Organized 1905, under laws of Arizona, with capitalization $10,000, shares $10 par.

EUREKA CONSOLIDATED MINING CO. **MEXICO.**

Mine office: Nombre de Dios, Durango, Mexico. Ores from surface are said to have assayed 2% copper and about 1 kilogram silver per ton.

EUREKA CONSOLIDATED MINING CO. **NEVADA.**

Succeeded, 1905, by Richmond-Eureka Mining Co.

EUREKA COPPER CO. **ARIZONA.**

Letters returned unclaimed from former office, 48 Wall St., New York. Lands, sundry claims, 8 miles west of Globe, Gila county, Arizona, showing a considerable body of low-grade ore. Idle for several years.

EUREKA COPPER MINES, LTD. **BRITISH COLUMBIA.**

Mine office: Nelson, Kootenay district, B. C. J. J. Malone, president. Organized 1906, under laws of British Columbia. Lands, 4 full and 3 fractional claims, including the Eureka mine, having a 150′ shaft showing good auriferous copper ore, from which 1,000 tons have been shipped to the Trail smelter. Has a steam plant and employs circa 25 men.

EUREKA COPPER MINING CO. **WYOMING.**

Mine office: Encampment, Carbon Co., Wyo. L. B. Rodgers, president; O. B. Thompson, secretary; Bernard McCaffrey, treasurer. Organized November, 1899, and reorganized 1902, under laws of Utah, with capitalization $500,000, shares $1 par. Lands, 5 claims, 3 miles southeast of Encampment, opened by a 140′ shaft. Made several small smelter shipments, 1903, but since idle, and supposed to owe about $6,000 to promoters.

EUREKA DEVELOPMENT CO. **ARIZONA.**

Office and mine: care of S. S. Sutton, superintendent, Bisbee, Cochise Co., Ariz. Lands, sundry claims, circa 6 miles northwest of Bisbee, in Tombstone Cañon, near the Modern and Empire mines.

EUREKA DEVELOPMENT CO. **ARIZONA.**

Office: Calumet, Mich. Letter returned unclaimed from former mine office, Tucson, Pima Co., Ariz.

EUREKA EXPLORATION CO. **COLORADO.**

Office: Sioux City, Iowa. Mine office: Eureka, San Juan Co., Colo. J. H. Moreland, superintendent. Ores carry gold, silver, lead and copper. Has steam and water power, and a 50-ton concentrator. Employed about 25 men, at last accounts.

EUREKA GOLD & COPPER MINING CO. **ARIZONA.**

Mine office: Jerome, Yavapai Co., Ariz. Employs 4 men. C. W. Woods, president; H. M. Gibbs, secretary and treasurer; Harry Gilmore, superintendent. Lands, 8 claims, 7 miles south of Jerome, near the Iron King, opened by tunnel, showing a 30′ vein with an 8′ paystreak carry-

ing auriferous bornite and chalcopyrite, with occasional visible gold. Has steam power.

EUREKA GROUP. **CALIFORNIA.**

Office: care of H. F. Dimock, Carrville, Cal. Lands, 2 claims, in Sections 17 and 18, T. 37 N., R. 7 W., Trinity county, California. Ore is silicious and low in grade. Has a 50′ tunnel. Idle.

EUREKA HILL MINING CO. **UTAH.**

Office: 11 East First South St., Salt Lake City, Utah. Mine office: Eureka, Juab Co., Utah. Employs circa 60 men. Moylan C. Fox, president; Geo. W. Riter, secretary and managing engineer. Organized November 12, 1875, under laws of Utah, with capitalization $1,000,000, shares $100 par. Is operated as a close corporation, and has paid considerable dividends, but accounts are not published. Annual meeting, third Tuesday in February. Lands, 5 claims, area 27 acres, patented, also a 25-acre mill-site and 100 acres miscellaneous lands, in the Tintic district. Mine is extensively developed, having a 1,500′ main working shaft, and about 25 miles of underground openings. Ore bodies are lenticular deposits, carrying cuprite, malachite and enargite, with average values of about 1.4% copper, 6% lead, 25 oz. silver and $3 gold per ton. There is a 450-h. p., steam plant at the mine, and a 500-h. p. steam plant at the mill. Main hoist is 16x48′, good for 1,600′, and equipment includes a 30-drill Norwalk air-compressor. Buildings, 16 in number, include a 30x50′ frame machine shop, 30x40′ frame carpenter shop, frame smithies of 30x30′, and 30x40′, and a 30x60′ foundry. The reduction plant includes a 25-ton combination mill, with concentrator and pan-amalgamation mill combined. Building is of wood, 240x250′, and has 100 gravity stamps, 2 Blake crushers, 2 Gates centrifugal crushers and 50 vanners. The amalgamating plant has 32 pans. Company has a sawmill. Production is principally silver and lead, copper being secured as a by product. Production, 1904, was 134,000 lbs. fine copper.

EUREKA-MABEL MINE. **ARIZONA.**

Letter returned unclaimed from former mine office, Patagonia, Santa Cruz Co., Ariz. Shipped one carload of hand-sorted ore, 1903, carrying argentiferous galena and tennantite.

EUREKA MINE. **HONDURAS.**

A property in the Orica Basin, department of Tegucigalpa, Honduras, said to produce gold, silver and copper, latter in small quantities, as a by-product.

EUREKA MINE. **VERMONT.**

Mine office: Corinth, Orange Co., Vt. E. L. Smith, general manager. Property includes the Eureka and Union mines, sometimes known as the Pike Hill mines. Presumably idle.

EUREKA MINING & MILLING CO. **ARIZONA.**

Office: P. O. Box 552, Tombstone, Ariz. O. B. Steen, president; E. P. Draper, vice-president; F. W. Goodbody, secretary: F. N. Wolcott, treasurer. Lands, 7 claims, in the Huachuca Mountains, Cochise county, near the Mexican line. The Copper Glance group, opened by tunnels, is

claimed to have shipped more than $100,000 worth of ore and concentrates, these giving smelter returns of about $150 per ton, averaging 27% copper, 184 oz. silver and $6 gold per ton. The Eureka group has produced about $15,000 worth of ore. Property is considered valuable, but the company is a dead-beat. Idle.

EUREKA MINING, SMELTING & POWER CO. **OREGON.**

Office: P. O. Box 63, Clarkston, Wash. Mine office: Imnaha, Wallowa Co., Oregon. W. E. Howard, secretary: G. E. Nehrhood, superintendent. Company declines to furnish a statement, but claims to have a fair amount of cash in the treasury, with no debts. Lands, 40 claims, patents applied for, but adverses filed. Idle, except for slight development work during 1905, and lacks economical transportation. A suit was brought, 1905, in the United States Circuit Court, at Spokane, Washington, by August Miller and 44 other shareholders, who filed a bill in equity, asking that the company be compelled to refund approximately $300,000, paid for 500,000 shares of stock sold to them, 1902, on fraudulent representations, by this company. It is asserted that the company claimed to have well developed mines, with much ore in sight and on the dump, and the plaintiffs allege that the company did not have 400 acres, or any other number, did not have any rich ore, any townsite, any water-power, any smelter-site, or any development of commercial value of any ore averaging over $3 per ton.

EUREKA-OPHIR MINES. **UTAH.**

Office. care of J. W. Cairns, Stockton, Utah. Is said to show some high-grade ore. Idle.

EUREKA-RICHMOND MINING CO. **NEVADA.**

Office: care of Alfred Fries, 92 Reade St., New York. Mine office: Eureka, Eureka Co., Nev. A. F. Holden, managing director. Organized, circa 1905, as a merger of the Eureka Consolidated Mining Co. and Richmond Mining Co. Is under the general management of the United States Mining & Smelting Co., which holds a considerable stock interest.

EUSTIS MINES. **VIRGINIA.**

Owned by Holloway Mining Co.

EUSTIS MINING CO. **QUEBEC.**

Mine office: Sherbrooke, Sherbrooke Co., Quebec. Property carries cupriferous iron pyrites. Idle.

EVANGELINA COPPER MINING CO. **MEXICO.**

Office: 204-202½ So. Broadway, Los Angeles, Cal. Mine office: Santa Catarina, Ensenada de Todos Santos, Baja California, Mexico. D. R. Wilder, president; J. H. Coleman, vice-president; Josephine H. Wilder, secretary and treasurer. Lands, circa 150 acres, showing outcrops of 15% ore, in a fissure vein ranging from a few inches to 6′ wide. Idle.

EVANS-TANZER CONSOLIDATED COPPER CO. **CALIFORNIA.**

Presumably dead.

EVELYN MINING & LEASING CO. **COLORADO.**

Mine office: Leadville, Lake Co., Colo. Morris Sterne, manager. Ores

carry gold, silver, lead, copper and zinc. Has steam power and employed about 40 men, at last accounts.

EVENING STAR MINING CO. **WYOMING.**

Mine office: Riverside, Carbon Co., Wyo. J. H. Bills, superintendent, at last accounts. Lands, sundry claims, lying circa 12 miles south of Encampment, in the Beaver Creek district of Carbon county, opened by an 800′ crosscut tunnel, showing a wide vein with a 2′ paystreak carrying very high-grade melaconite, malachite and chalcocite. Is developing on a small scale.

EVERETT MINE. **NORTH CAROLINA.**

Owned by North Carolina Copper Mining Co.

EVERGREEN BLUFF MINE. **MICHIGAN.**

An old mine, lying south of the Adventure and Mass mines, in Ontonagon county, Michigan. Produced 675 tons, 1,174 lbs. fine copper, at a cost of $223,582.24, from 1854 to 1863, but since idle.

EVERGREEN-EUREKA GOLD & COPPER CO.

Office: 31 Union Sq., New York. At last accounts was endeavoring to peddle stock, accompanied by a personal guaranty of 5% dividends, and a 10-year bond against loss. Evidently is a mere stock-jobbing scheme.

EVERGREEN GOLD & COPPER MINES CO. **COLORADO.**

Office and mine: Apex, Gilpin Co., Colo. Jos. L. Walters, president and general manager; W. C. Hollister, secretary and treasurer. Organized 1904, under laws of Colorado, with capitalization $500,000, shares $1 par. Lands, 6 claims, 3 patented, area 33 acres, also a 10-acre placer claim and a half-acre millsite, in the Pine district, showing two fissure veins, of which one, opened by 3 shafts of 40′ to 80′ depth, and by tunnels of 150′ and 400′, carries malachite, bornite, chalcopyrite and tetrahedrite. Carload shipments, 1905, gave returns of 31% copper and 24 oz. silver from first grade ore, and 15% copper and 12 oz. silver from second grade ore. Construction of a small smelter is planned. Management is said to be conservative, and to be developing along sensible lines.

EVERGREEN MINING & TUNNEL CO. **UTAH.**

Office: care of H. G. McMillan, manager, Salt Lake City, Utah. Letter returned unclaimed from former mine office, Alta, Salt Lake Co., Utah. Has a prospecting tunnel, with about 1,700′ of workings, said to show considerable low-grade copper ore.

EXCELSIOR COPPER CO. **ARIZONA.**

A swindle, perpetrated by the notorious Wm. F. Wernse gang.

EXCELSIOR COPPER CO. **QUEBEC.**

Mine office: West Broughton, Megantic Co., Quebec. Mine is developed by shaft and open-cuts. Has steam power. Presumably idle.

EXCELSIOR COPPER & GOLD MINING CO. **WYOMING.**

Letter returned unclaimed from former mine office, Aetna, Wyo.

EXCELSIOR GOLD & COPPER MINING CO. **ARIZONA.**

Office: Nevada Blk., San Francisco, Cal. Lands, 20 claims, in vicinity of Flagstaff, Coconino county, Arizona.

EXCELSIOR MINE. **NEW MEXICO.**

Mine office: Jarilla, Otero Co., N. M. Has a shaft, on the Nashville claim, said to show a 4′ vein of 4% sulphide ore, and plans installation of a mining plant.

EXCELSIOR MINING CO. **NEW MEXICO.**

Letter returned unclaimed from former mine office, Organ, Donna Ana Co., New Mexico. Gilbert E. Dunbar, owner. Lands show argentiferous copper ore.

EXCELSIOR MINING & SMELTING CO. **NEVADA.**

Office: Butte, Mont. Letter returned unclaimed from former mine office, Yerington, Lyon Co., Nev. John F. Forbes, president; Frank E. Shaw, secretary. Capitalization $200,000. Property was the Bluestone mine, opened by tunnels, equipped with steam and gasoline power, and having oxide and carbonate ores, claimed to average 10% copper, with a 150-ton water-jacket furnace, installed 1901. Is thought property has passed to other hands.

FAEO GRUBE. **NORWAY.**

A group of small Norwegian mines, producing a limited quantity of ore, averaging 4% in copper tenor, at last accounts.

FAHLERZ- UND KUPFERKIESBERGBAU. **AUSTRIA.**

Mine office: Altaech Zapfenschuh, Tyrol, Austria. Was a small producer of sulphide copper ore, at last accounts.

FAIRVIEW MINING CO. **MONTANA.**

Mine office: Basin, Jefferson Co., Mont. Ores carry gold, silver and copper. Mine is opened by shaft and tunnel. Presumably idle.

FAMATINA COPPER & GOLD SYNDICATE, LTD. **ARGENTINA.**

Succeeded, Jan. 21, 1903, by Famatina Development Corporation, Ltd.

FAMATINA DEVELOPMENT CORPORATON, LTD. **ARGENTINA.**

Offices: 56, Cannon, St., London E. C., Eng. Mine office: Chilecito, Rioja, Argentina. Capt. W. B. McTaggart, chairman; Benito Villanueva, local director; John Taylor & Sons, consulting engineers; A. Dangerfield, secretary; E. Dangerfield, mine manager. Organized January 21, 1903, with capitalization £400,000, shares £1 par; issued, £266,268. Debentures, £100,000 authorized; issued, £70,100, at 6%, on first mortgage, redeemable at £105. Income bonds, £50,000, without interest, repayable at face, plus 25%, out of profits, and convertible into debentures. Succeeded the Famatina Copper & Gold Syndicate, Ltd.

Property is 4 groups of claims, in the Mexicana district, Famatina Mountains, known as the Mellizas group, area 75 acres, Upulungos group, area 7 acres, Compañía group, area 15 acres, and San Pedro group, area 45 acres. Property is claimed to show 14 auriferous and argentiferous copper veins, of 4′ average width, by circa 2 miles in length. Company is alleged to practically control the Mexicana mining district, but area of lands reported does not seem to bear out this claim. The Upulungos mine is said to show a 1,000′ ore chute. Property shows an intricate network

of fissure veins, traversing country rock of metamorphic slate, ores occurring in irregular chutes.

Smelter site is at Chilecito, and a 25-mile aerial tram is planned to connect the mines and works, it being estimated that this tram should cut the cost of transportation to a fraction of the present figure of 35 shillings per ton. The Córdoba Central railway is to be extended to the Mexicana district, eventually reaching Chilecito. Water is abundant, and wages for native labor, which is inefficient, average about 30 cents per day. Sample shipments of 900 long tons, put through the Chilecito smelter, 1905, are said to have given net profits of £2 per ton. Messrs. John Taylor & Sons, who are engineers of the highest standing, examined the property carefully, in 1905. Their report shows considerable ore, in veins ranging from a few inches to several feet in width, with average assays, from careful sampling, running 3% to 4% copper, 10 oz. to 15 oz. silver, and 4 dwts. to 5 dwts. gold per long ton. The report of the engineers recommends that nothing but development work be done for the present, reserving building of a reduction plant until the mines be more adequately developed. This report calls for the expenditure of about £100,000. The Famatina company, having reached the end of its resources, a new corporation has been formed, called the International Copper Co., Ltd., which is to finance the Famatina, up to £60,000.

LES MINES DE CUIVRE DE LA FARE, LTD. **FRANCE.**

Offices: Dashwood House, New Broad St., London, E. C., Eng. R. Romeu, secretary. Organized Oct. 25, 1904, as Les Mines Francaises, name changed to present title, November, 1902, with capitalization £47,000, shares £1 par, in £30,000 cumulative 8% preference and £17,000 common shares; issued, £19,997. Property, in France, known as La Fare, is said to show 6 veins, and it is claimed that a reduction plant is being built.

COMPAÑIA MINERA DE FARELLON. **CHILE.**

Mine office: Puquios, Copiapó, Atacama, Chile. Presumably an erroneous title for the Farellon mine of the Copiapó Mining Co., Ltd.

FARGO GOLD & COPPER MINING CO. **OREGON.**

Office: Fargo, N. D. Mine office: Imnaha, Wallowa Co., Ore. H. M. Peterson, president; J. A. Husebye, secretary and treasurer; Charles Wallace, superintendent. Lands include the Last Chance mine, carrying auriferous and argentiferous copper ores. Has water power.

FARMINGTON GOLD & COPPER MINING & MILLING CO. **UTAH.**

Office: care of J. Stuart Wallingford, secretary and treasurer, Paris, Ky. Mine office: Farmington, Davies Co., Utah. C. H. White, president; Anton Hartman, superintendent. Capitalization, $250,000, shares $1 par. Former manager, Fred. H. Perkins, was arrested, 1906, on charge of embezzling $2,000 from the company.

FARRELL COPPER CO. **MONTANA.**

Succeeded, circa 1902, by Pittsburg & Montana Copper Co.

FAUQUIER COPPER CO. **VIRGINIA.**

Supposed to hold copper lands in Fauquier county, Virginia.

FAVORITE GOLD & COPPER MINING CO. **WASHINGTON.**

Office: Nelsonville, Ohio. Mine office: Nighthawk, Okanogan Co., Wash. J. M. Parker, president; J. F. Baldridge, secretary; H. D. James, general manager; Ed. Williams, mine superintendent. Lands, 14 full and 14 fractional claims, adjoining the Nighthawk mine, on Mt. Ellemeham, in the Wanicutt Lake district, 34 miles from the Canadian Pacific railway, showing 5 veins, of which one, ranging 1′ to 5′ in width, is opened by a 950′ upper tunnel and an 850′ lower tunnel on the Giant claim, latter driven on a 3′ vein of ore, showing values in lead, silver, copper and gold, principally the former.

MINA LA FÉ. **MEXICO.**

Mine office: Jimulco, Coahuila, Mexico. Pearson & Randall, owners; Geo. Pearson, manager. Ores carry copper, gold and silver. Presumably idle.

FEDERAL COPPER CO. **MICHIGAN.**

Office: 207 First Nat'l Bank Bldg., Duluth, Minn. Peter L. De Voist, president; F. D. Adams, secretary and treasurer. Organized 1902, under laws of Minnesota, with capitalization $600,000, shares $10 par. Lands, 360 acres, adjoining the Miskwabik, in Houghton township, Keweenaw county, Michigan. Property is supposed to carry the northern extension of the Kearsarge amygdaloid. Idle.

FEDERAL COPPER CO. **WYOMING.**

Letter returned unclaimed from former office, Laramie, Wyo. Was supposed to have lands in Carbon or Albany counties, Wyoming.

FEDERAL COPPER CO., LTD. **WISCONSIN.**

Apparently succeeded, circa 1902, by Federal Gold & Copper Co.

FEDERAL COPPER MINING & SMELTING CO. **ARIZONA, NEW MEXICO & TEXAS.**

Office: New York. Floyd H. Wilson, president; J. H. Russell, receiver, care of State National Bank, El Paso, Texas. Property was a 100-ton smelter, at El Paso, Texas; also mineral lands in the Organ Mountains, Donna Ana county, New Mexico, and a controlling interest in the Dragoon Mining Co., at Johnson, Cochise county, Arizona.

FEDERAL GOLD & COPPER CO. **NEVADA & WISCONSIN.**

Office: 214 Lumber Exchange, Minneapolis, Minn. Mine office: Dayton, Lyon Co., Nev. C. S. Dudley, president and general manager; M. B. Coburn, vice-president; H. S. Dudley, secretary and treasurer. Organized 1902, under laws of Arizona, with capitalization $2,500,000, shares $1 par. Lands include 600 acres in the St. Croix valley, Burnett county, Wisconsin, and 520 acres 6 miles southeast of Superior, Douglas county, Wisconsin, these tracts lying on the St. Croix and Minong native copper ranges. Landed holdings in Nevada were 7 claims, in the Como district, including the Como-Eureka mine, showing 4 parallel veins, estimated by management to carry average values of $8 to $20 per ton. Mine has a 350′ shaft, with 750′ of drifts and crosscuts. Equipment includes an electric light plant and a 100-ton concentrator. Mill was run for several months, late in 1905, apparently for gold values, and produced about $16,000. As management estimates

average cost of mining and milling at $3.50 or less per ton, it is evident, either that value of ore has been overestimated, cost of mining and milling overestimated, or that amount of ore in sight is very small.

FEDERAL GOLD & COPPER MINING CO. **UTAH.**

Office: 612 McCornick Bldg., Salt Lake City, Utah. Mine office: Blue Acre, Beaver Co., Utah. Hon. Heber Wells, president; A. Stuart, secretary; E. W. Young, general manager; J. E. Meyer, superintendent; W. A. Wilson, engineer. Organized Jan. 20, 1903, under laws of Utah, with capitalization $1,000,000, shares $1 par. Lands, said to be 9 patented claims, area 180 acres, in the Beaver Lake district, between the O. K. mine of the Majestic and the properties of the Newhouse company, but it has been asserted that there are adverses on 4 claims. Property shows a number of fissure and contact veins, carrying gold, silver, copper and lead, in country rocks of granite-porphyry, quartzite and limestone, opened by a 40′ tunnel and 9 pits and shafts, deepest 80′. Was discovered and worked many years ago, producing about $100,000 worth of ore. Property regarded as promising. Idle.

FEDERAL MINES CORPORATION. **COLORADO.**

Mine office: Idaho Springs, Clear Creek Co., Colo. Ores carry gold, silver, lead and copper. Has steam power.

FEDERAL MINING CO. **ARIZONA.**

Reorganized, 1905, as Gila Valley Copper Co.

SOCIETA MINIERE DELLA FENICE MASSETANA. **ITALY.**

Mine office: Massa Marittima, Grosseto, Italy. Property shows veins or lenses, ranging 6″ to 65′ in width, carrying chalcopyrite, associated with iron pyrites, in a quartz gangue, and occasional native copper. First-grade ore, averaging about 11% copper, is heap-roasted at the mine and smelted at Leghorn, and second-grade ore, averaging about 3% copper, is heap-roasted and leached at the mine.

FENOCHIA MINING CO. **MEXICO.**

Letter returned unclaimed from former mine office, Magdalena, Sonora, Mexico.

FENTRESS MINING CO. **NORTH CAROLINA.**

Office: 52 Broadway, New York. Mine office: Center, Guilford Co., N. C. Henry J. Dexter, president; Chas. W. Scott, secretary. Property is the Fentress, or North Carolina mine, opened and worked previous to circa 1860. Has a 3′ to 4′ vein, dipping at 38° to 60°, opened to depth of 310′. Has steam power and 10-stamp mill, producing gold bullion and copper concentrates, when working. Presumably idle.

FERNANDO MINING CO. **MEXICO.**

Office: 12 Ashburton Place, Boston, Mass. Mine office: San Fernando, Tamazula, Durango, Mex. Col. T. L. Livermore, treasurer; Courtney de Kalb, manager. Ores carry gold, silver and copper. Has water and electric power, with concentrator, and employed circa 250 men, at last accounts. Production, 1903, was 554,609 lbs. fine copper.

FERRIS-HAGGARTY COPPER MINING CO. **WYOMING.**

Controlled, through stock ownership, by Penn Wyoming Copper Co.

COMPAÑIA DE MINAS FERROCOBRIZAS. **SPAIN.**

Office: San Isidro, 16, Sevilla, Spain. Mine office: El Carpio, Cortegana, Huelva, Spain. Don Salvador Sánchez Castañer, agent. Lands, 11 old mines, including the Santa Maria de Gracias, area 73 hectareas, leased to the Sociedad Francaise de Etudios, of Paris. Mines were worked in very ancient days. Ore is cupriferous iron pyrites, to be shipped, over a new railroad line, to Valdelamusa, for export.

MINAS FÉ y ESPERANZA. **SPAIN.**

Mine office: Ribas, Gerona, Spain. Are working on a small scale.

FIDELITY MINING CO., LTD. **MICHIGAN.**

Office: care of I. P. Griswold, chairman, Allegan, Mich. C. G. Turner, secretary; H. F. Marsh, treasurer. Organized February, 1903, with capitalization $300,000. Lands are in Section 15, T. 50 N., R. 40 W., 2½ miles northwest of the Victoria mine, Ontonagon county, Michigan. No mining work done.

MINA FILOMENA. **CHILE.**

Mine office: Chañaral, Atacama, Chile. Baldomero Luna, owner; N. Rojas, superintendent. Has steam power, employing circa 50 men.

FINLETTER & HARVEY. **ARIZONA.**

Mine sold, 1905, to Keystone Copper Co.

FINLEY GOLD & COPPER MINING & MILLING CO. **UTAH.**

Letter returned unclaimed from former mine office, La Sal, Utah. C. A. Finley, general manager. Lands were 3 claims, at the foot of Horse Mountain, carrying ores giving returns of $32.40 per ton, from small smelter shipments.

FIRE STEEL MINE. **MICHIGAN.**

Lands, 160 acres, being the NW ¼ of S. 22, T. 51 N., R. 37 W., Ontonagon county, Michigan. Opened 1852, closed 1855; since idle.

FIRMINA COPPER CO.

Organized June, 1905, under laws of Maine.

FIRST CHANCE MINING CO. **WASHINGTON.**

Mine office: Excelsior, Pierce Co., Wash. F. M. Lewis, president. Ores are refractory and company plans roasting them.

FISKUM SYNDICATE, LTD. **NORWAY.**

Offices: Basildon House, London, E. C., Eng. Mine office: Kongsberg, Norway. C. S. Goodwin, secretary. Organized March 2, 1905, with capitalization £2,400, shares £1 par; issued, £2,375. Property is an option on 50 claims, carrying copper, lead and zinc, on which a little work has been done.

FITZROY COPPER MINES, LTD. **AUSTRALIA.**

Offices: 11, St. Helen's Pl., London, E. C., England, and 79, Pitt St., Sydney, New South Wales, Australia. Mine office: Mt. Chalmers, Queensland, Australia. P. Charley, chairman; C. S. Goodwyn, secretary. Organized August 15, 1902, with capitalization £18,000, shares £1 par; issued,

£8,097. Property is the Mt. Chalmers mine, area 140 acres, near Rockhampton, reopened 1902, after many years' idleness, property being held under option of purchase. The mine has large lenses of ore, occurring in sedimentary rocks, in connection with dioritic intrusions. Ores are auriferous and slightly argentiferous iron-copper sulphides, giving average returns of about 1.5% copper, 1 dwt. silver and 4 dwts. gold per long ton. Property is 4 miles from a state railway. Equipment includes a small steam plant, mill with 20 gravity stamps and vanners, and a 60-ton smelter, but wet concentration does not seem to have given successful results, and mine should be worked open-cast.

FIVE METALS MINING CO. **ARKANSAS.**

Correct title is North Arkansas Zinc, Copper, Lead, Silver & Gold Mining Co.

FIVE POINTS COPPER MINING CO. **ARIZONA.**

Mine office: Globe, Gila Co., Ariz. A. T. Hammons, treasurer; J. C. Britt, superintendent. Lands, sundry claims, including the Clark, Lockwood, and Van Wagenen groups, area 34 claims, lying near the Gibson Copper Co., 14 miles west of Globe, near the head of Pinto Creek, with 5 additional claims near Bloody Tanks. Property shows malachite, near surface, with some azurite and chalcocite at a little depth, and the company claims to have thousands of tons of 4% to 10% copper ore. Mine has given ores assaying up to 38% copper and 49 oz. silver per ton, with a trace of gold. The 350′ Cracker Jim shaft shows a 29′ vein, giving assays of 4% to 12% copper. The 150′ Solace incline shaft is 1,500′ from the Cracker Jim. An 80-h. p. first-motion hoist has been ordered, and plans have been drawn for a 325-ton concentrator. Shipments were begun, to the Old Dominion smelter, March, 17, 1906. Property is considered promising.

W. S. FLETCHER MINING & SMELTING CO. **ARIZONA & CALIFORNIA.**

Succeeded, March, 1905, by Arizona-Mexican Mining & Smelting Co.

FLINT STEEL MINE. **MICHIGAN.**

A tract of 400 acres, near the Michigan mine, in Ontonagon county, Michigan. Produced 415 tons, 458 lbs. fine copper, at a considerable loss. Idle since circa 1875.

FLORENCE MINING CO. **UTAH.**

A company by this name is said to have 640 acres, in the extreme eastern part of the Uintah Reservation, Utah, with a promising copper showing.

FLORENCE MINING, MILLING, SMELTING & REFINING CO. **COLORADO.**

Office: Florence, Colo. Lands, 18 claims, in Custer county, Colorado, showing a small vein giving good assays in copper. Presumably idle.

FLORENCE SMELTING, MINING & MILLING CO. **ARIZONA.**

Office: care of J. H. McCabe, president and manager, Phœnix, Ariz. Mine office: Price, Pinal Co., Ariz. Lands include the Mineral Hill group, Grace, Blue Bell, Alice and other properties, having lead

and copper ores. Company has a smelter, with a 35-ton lead stack, apparently moved from Phœnix to Price, and is said to plan erection of a copper stack.

FLYING DUTCHMAN MINING CO. **UTAH.**

Lands are somewhere in Tooele county, Utah, near the property of the new Utah Mining Co. Herman Hoesh, superintendent.

F. M. & D. COPPER MINING CO. **COLORADO.**

Office: care of Bernard McCaffrey, Denver, Colo. Mine office: Morrison, Jefferson Co., Colo. Lands, 560 acres, patented, near Bear Creek, about 8 miles west of Morrison, opened by 600′ of tunnels and a 165′ main shaft, upper 150′ passing through a gossan capping of 15′ to 30′ width, carrying small gold values, and showing about 5′ of ore in the bottom, mainly sulphide, with some malachite, said to carry circa 11% copper and $3.50 gold and silver per ton.

FOLDAL COPPER & SULPHUR CO., LTD. **NORWAY.**

Offices: 6, Old Jewry, London, E. C., Eng. Alex. Davidson, Leigh Hoskyns, Stanley Clay and Sidney St. J. Steadman, directors; Chas. Forbes, secretary. Organized 1906, with capitalization £350,000, shares £1 par, in 150,000 shares preferred and 200,000 shares ordinary stock. Lands are four old mines, known as the Juliana Marie, Knutshovd, Grev Moltke and Grimsdal, area circa 3,000 acres, in the Röros district of Norway. Properties were worked for about 150 years, and have produced circa 350,000 tons of ore. It is estimated by the management that about 250,000 long tons are now ready for stoping. Mines show a vein of circa 10′ width, of practically solid cupriferous iron pyrites, said to average 2% copper and 46% sulphur, and, if this estimate holds good, the property scarcely can fail to make a profitable mine, under good management. An aerial tram or narrow-gauge railroad is required, for production to the best advantage.

FOND DU LAC MINE. **WISCONSIN.**

A prospect, in Douglas county, Wisconsin, on which two shafts, deepest 65′, were sunk in 1899, giving a fine showing of native copper rock, said to have been brought from Michigan for the purpose.

FORAN MINE. **ARIZONA.**

Office and mine: Stoddard, Yavapai Co., Ariz. Samuel Foran, owner.

FORD COPPER CO. **COLORADO.**

Letter returned unclaimed from former mine office: Georgetown, Colo. Property, in Eldorado county, Colorado, was said to carry values in gold and copper, former predominating.

FOREST MINE. **WASHINGTON.**

Mine office: Darrington, Snohomish Co., Wash. Thos. Parks, superintendent. A prospect, slightly developed by tunnel. Presumably idle.

FOREST HILL CONSOLIDATED MINING & MILLING CO. **COLORADO.**

Office: 420 Exchange Bldg., Denver, Colo. Mine office: Tin Cup, Gunnison Co., Colo. L. Cavnah, president; J. C. Jensen, secretary and superintendent. Has steam power and two-stamp mill. Company has been endeavoring, since circa 1896, to develop gold, silver, lead or copper mines, at Tin Cup and elsewhere. Presumably idle.

EDWIN FORREST. **NEW MEXICO.**

Office and mine: High Rolls, Otero Co., N. M. Said to have claims, opened by 40′ shaft, showing a 12′ vein of copper ore.

COMPAÑIA MINERA LA FORTUNA. **MEXICO.**

Mine office: Tepezalá, Aguascalientes, Mexico. Geo. B. Wardman, superintendent. Operates La Fortuna and adjoining mines, opened by shafts, carrying copper and silver ores. Uses animal power and employs about 300 men.

FORTUNA COPPER CO. **CALIFORNIA.**

Office and mine: Fortuna, Humboldt Co., Cal. P. J. Mulley, president and general manager; Frank Legg, vice-president; C. A. Eastman, secretary; Fortuna Merchandising Co., treasurer; A. E. Purdy, superintendent. Organized June 8, 1901, under laws of California, with capitalization $70,000, shares $5 par. Lands, 32 claims, area 640 acres, in Trinity county, California, opened by tunnels of 60′ and 270′, showing ores that have assayed 28% copper and $3 gold per ton, in veins of 12″ to 16″ width.

FORTUNA GOLD & COPPER CO. **ARIZONA.**

Office and mine: care of C. M. Clark, president, Phœnix, Maricopa Co., Arizona. Lands, 5 claims, including the Scarlet mine, circa 20 miles north of Phœnix, said to give a promising ore showing.

FORTUNA GRANDE COPPER CO. **NEVADA.**

Letter returned unclaimed from former mine office, Ely, Nevada.

FORTUNA GROUP. **CALIFORNIA.**

Office: care of E. G. Harrison, owner, Callahan, Cal. Lands are in Siskiyou county, California. Ore is chalcopyrite associated with pyrrhotite, traversing diorite, opened by shafts. Presumably idle.

FORTUNA MINING CO. **MEXICO.**

Office and mine: La Cananea, Sonora, Mexico. J. A. Daugherty, president and general manager; M. J. Thomas, vice-president; B. S. Pelzer, secretary; P. J. Tehaney, treasurer; Peter Kemp, superintendent. Organized July 3, 1905, under laws of Arizona, with capitalization $1,500,000, shares $5 par. Lands, 124 pertenencias, 20 miles south of Cananea, in the Sierra Azul Mountains. Property, opened by Mexicans, was abandoned, circa 1880, on account of water. Ores are argentiferous lead and copper, with lead values predominating.

FORTUNA MINING CO. **UTAH.**

Office: care of George F. Richards, Jr., secretary and treasurer, Salt Lake City, Utah. Mine office: Bingham Canyon, Salt Lake Co., Utah. Employs 45 men. Simon Bamberger, president; Sidney Bamberger, general manager. J. Start, superintendent. Organized March 10, 1904, with capitalization $300,000. Lands, circa 200 acres, adjoining the Ohio Copper Co., showing considerable development.

A blind shaft, starting from a tunnel, is planned to be deepened, on the vein. Property is said to show a 4′ vein averaging 35% lead, 8 oz. silver and 0.08 oz. gold per ton, also a 7′ vein averaging about 15% copper, but

these estimates are too high. Has a gasoline hoist and an old mill, which it is planned to equip with new concentrating tables. Property is regarded as promising.

FORTUNA MINING & MILLING CO. **UTAH.**

This property, at Bingham Canyon, Salt Lake county, Utah, is under lease to, and is operated by, the Bingham Consolidated Mining & Smelting Co.

FORTUNE COPPER & FINANCE CO., LTD.

Offices: 10, Basinghall St., London, E. C., Eng., Organized July 22, 1901, with capitalization £25,000.

FORTY-FIVE CONSOLIDATED MINING CO. **WASHINGTON.**

Dead. Lands now held by Magus Mining Co.

FORTY-SEVEN MINE. **WASHINGTON.**

Letter returned unclaimed from former mine office, Index, Wash.

FOSS RIVER CONSOLIDATED COPPER CO. **WASHINGTON.**

Office: 315 American National Bank Bldg., Everett, Wash. Employs 9 men. Albert McIntyre, president and general manager; E. A. Nickerson, vice-president; F. B. Smith, secretary; Leighton Howard-Smith, treasurer; Millnor Roberts, engineer. Organized December 10, 1901, under laws of Washington, with capitalization $1,000,000, shares $1 par. Lands, 18 claims, area 33 acres, also a 30-acre millsite and 40 acres of timber lands, in the Foss River district of King county, Washington, opened by a 55′ shaft and tunnels of 35′, 45′, 65′ and 310′, showing several veins, of which the largest, estimated at 180′ width, shows bornite and chalcopyrite, giving assays of 3% to 54% copper, 2 oz. to 40 oz. silver and 80 cents to $4 gold per ton. Management plans continuation of development work and installation of water power and 4-drill air-compressor.

FOULD et COMPAGNIE. **SPAIN.**

Office: Paris, France. Mine office: care of Don Guillermo Sundheim, agent, Huelva, Spain. Property includes La Cartagenera and other mines, at Cazalla de la Sierra, Sevilla, Spain, undergoing exploration at last accounts.

FOUR B'S MINING CO. **COLORADO.**

Mine office: Turret, Chaffee Co., Colo. David Allen, superintendent at last accounts. Operates the Jasper mine, carrying gold, silver and copper ores. Has gasoline power.

FOUR BROTHERS MINE. **WASHINGTON.**

Letter returned unclaimed from former mine office, Silverton, Snohomish Co., Wash. Lands were 4 claims, having about 500′ of development work, mainly tunnels, showing ores carrying copper gold and silver. Idle.

FOUR METALS MINING CO. **ARIZONA.**

Office: 21 South Center St., Phœnix, Ariz. Mine office: Washington. Santa Cruz Co., Ariz. F. L. Blumer, president and treasurer; Oliver P. Morton, vice-president; H. A. Owen, secretary; Geo. D. Gross, manager; preceding officers and E. E. Barrett, directors. Organized 1903, under laws of Arizona, with capitalization $2,000,000, shares $1 par. Lands, 40 claims, area 680 acres, south of the Mowry mines, in the Patagonia dis-

trict, opened by shaft and tunnel, with circa 3,500′ of workings, showing ores giving fair assay values in copper, lead, silver and gold. A small test shipment of ore, from the Chamberlain tunnel, to the El Paso smelter, gave net returns of $60 per ton. Management plans building a mill.

FOUR METALS MINING CO. **COLORADO.**

Office: Equitable Bldg., St. Louis, Mo. Letter returned unclaimed from former mine office, Silverton, San Juan Co., Colo. W. Frank Carter, president; R. M. Scruggs, secretary and treasurer; Joseph H. Shockley, superintendent. Organized January 17, 1899, under laws of Colorado, with capitalization $2,000,000, shares $1 par. Lands were 47 claims, area 516 acres, at Silverton, San Juan county, and in Ingraham basin, near Telluride, San Miguel county, Colorado. Had a mill at the Palmyra mine, and a steam plant at the Andrus mine, near Telluride.

FOUR METALS MINING CO. **UTAH.**

Office: care of G. L. Moats, general manager, Salt Lake City, Utah. H. Hugo Brandeis, president; R. P. Hill, secretary. Lands are in the Dugway, or Deep Creek district, Utah, and carry auriferous and argentiferous copper, zinc and lead ores. Mine is opened to depth of 400′ and has a small concentrator. Presumably idle.

FOURTH OF JULY MINING & MILLING CO. **COLORADO.**

Mine office: Eldora, Boulder Co., Colo. J. B. Johnson, superintendent. Is opened by shafts and has a 220′ tunnel, planned to cut the Olympic and Fourth of July veins, from which assays of 25% to 45% copper, some lead, 50 oz. to 125 oz. silver, and $30 to $80 gold per ton, have been secured. Idle.

DUNCAN FOX y CA. **CHILE.**

Mine office: Cobija, Tocapilla, Antofagasta, Chile. Firm owns a large number of copper claims, near Cobija and elsewhere, in the Tocapilla district of the province of Antofagasta.

SOCIÉTÉ DES MINES et FONDERIES DE FRANCADO. **CORSICA.**

Mine office: Ajaccio, Corsica. Capitalization, 200,000 francs, shares 100 francs par. Lands are extensive, holdings, including the Morosaglia, San Lorenzo and other copper deposits, said to carry an average of 7% copper ore.

SOCIÉTÉ FRANCAISE DE ETUDIOS. **SPAIN.**

Office: Paris, France. Mine office: El Carpio, Cortegana, Huelva, Spain. Property is sundry old mines of cupriferous iron pyrites, leased from the Compañía de Minas Ferrocobrizas.

COMPAGNIE FRANCAISE DES MINES DE CUIVRE D'AGUAS TENIDAS. **SPAIN.**

Succeeded by Société Francaise des Pyrites de Huelva.

COMPAGNIE FRANCAISE DES MINES DE CUIVRE D'AKHTALA. **RUSSIA.**

Offices: Rue Tronchet, 27 bis, Paris, France. Lands, sundry copper properties, in the Russian Caucasus. Presumably idle.

SOCIÉTÉ FRANCAISE DES PYRITES DE HUELVA. **SPAIN.**

Offices: Rue de Chateaudun, 39, bis Paris, France. Mine office: Valdelamusa, Huelva, Spain. Don Carlos Marchal, agent; Victor Prevost, superintendent. Organized December, 1899, with capitalization 3,500,000 francs. Company succeeded the Société Francaise des Mines de Cuivre d'Aguas Tenidas. Lands include sundry mines, among these being the Confesonarios at Valdelamusa, Perrunal and others at Cortegana, and El Carpio at Huelva. Product is cupriferous iron pyrites, and for 1904, production was 157,821 metric tons of raw ore, and 13 tons of cement copper. While low in copper tenor, the ores are rich in sulphur.

SOCIÉTÉ FRANCAISE MINIÉRE ET MÉTALURGIQUE EN SERBIE. **SERVIA.**

Offices: Rue de Courcelles, 147, Paris, France. Lands are sundry copper claims in Servia.

ANDRES FRANCHY. **PERÚ.**

Mine office: San Marcelo, Yauli, Perú. Is a small producer of argentiferous copper ores.

SOCIÉTÉ MINIÉRE ET MÉTALURGIQUE FRANCO-ESPANGNOLE. **SPAIN.**

Offices: Rue de Lisbonne, 8 bis, Paris, France.

FRANCISCO ARMANDAIZ SUCESORA. **MEXICO.**

Office: Apartado Postal 37, Monterey, N. L., Mex. Mine office: Cerralvo, Nuevo León, Mex. Property includes the Refugio and Barredon, which are producers of slightly argentiferous lead ores, and excellent properties, also the Colorado mine, carrying copper up to 3%. Properties employ about 50 men, and are said to be under bond and lease to New York parties.

FRANKLIN MINING CO. **MICHIGAN.**

Office: 46 Congress St., Boston, Mass. Mine office: Hancock, Houghton Co., Mich. Employs about 600 men. Francis H. Raymond, president; Daniel L. Demmon, secretary and treasurer; R. M. Edwards, manager; preceding officers, John C. Watson and Stephen R. Dow, directors; Cyrus Truan, mining captain at old Franklin; John Doney, mining captain at Franklin Junior; Arno Jaenig, clerk; Edward Warne, mill superintendent. Organized April 3, 1857, under laws of Michigan; reincorporated, 1887, for 30 years; capitalization since increased to $2,500,000, shares $25 par.

Official returns to the state of Michigan, as of date January 1, 1905, disclose the following figures:

Amount of cash paid in on capital stock	$1,040,333.58
Entire amount invested in real estate	54,901.50
Amount of personal estate	234,575.81
Amount of floating debt	108,882.21

Amount paid in by conveyance of property is unknown, as old books were burned.

Lands include 160 acres at the old Franklin, 1,359 acres of surface, and mineral rights to 160 acres, at the Franklin Junior, and a millsite at Grosse

Pointe of nearly 200 acres area with one mile frontage on Portage Lake. The old mine consists of the southwest quarter of Section 2, Town 55 North, Range 33 West. The Junior mine, opened 1860, as the Albany & Boston, was renamed the Peninsula in 1882, and was bought by the Franklin in 1895.

The old Franklin mine, opened on the Pewabic bed, is surrounded on three sides by the Quincy mine, which has cut off the Franklin from following the lode beyond the boundary line. The old Franklin is producing about 300 tons of rock daily from shaft No. 3, which is 3,200′ deep, and No. 5, which is 2,850′ deep, both bottomed at the Quincy line. Mining is almost exclusively scramming old ground and robbing pillars, lower levels having been gutted. The pillars removed are usually of good grade, but the reworked ground varies greatly, ranging from the best grade of stamp rock and heavy copper down to almost barren rock. A little native silver is produced by the Pewabic lode, this being picked out by boys in the stamp mills. The old mine is nearing exhaustion, but has been at the point of death for ten years, and its vitality renders all predictions as to the date of its demise extra-hazardous. Parallel with the Pewabic lode, and lying 300′ to the westward, is the so-called West Lode. This carries copper in variable quantities, but several fair stopes were developed thereon, during 1905, and are being worked through the old openings.

The Franklin Junior has two separate mines, these being the old Albany & Boston, on the Allouez conglomerate, which is the mine now worked, and a mine opened on the Pewabic amygdaloid, circa 1896–1899, the latter lying 475′ west of and parallel with the first-named mine. The amygdaloid shafts are numbered from north to south, the north shaft being about 900′ south of the Rhode Island line, and approximately 1,000′ deep; No. 1 is 1,100′ next south and about 1′600, deep; No. 2 is 1,500′ further south and about 1,200′ deep; No. 3 is 1,100′ next south, and is about 400′ in depth. The four shafts are sunk at an angle of 48° 30″, on a lode varying from 3′ to 15′ width, with an average of circa 9′. Average returns secured from this lode were only about 0.45%, or 9 lbs. fine copper per ton of rock crushed, hence the amygdaloid shafts were abandoned February, 1902, but at 2,000′ to 2,500′ depth a crosscut may be sent to the amygdaloid, from the conglomerate workings.

The results given by the Pewabic amygdaloid proving unsatisfactory, the old Albany & Boston mine, on the Allouez conglomerate, was reopened in 1900. No. 1 shaft was cut down to three-compartment size, 7x20′ over all, with inside measurement of 6′ 6″x18′ 6″. This shaft, 2,100′ deep, has a direct hoist, raising 6-ton skips, good for one-mile depth. The two bottom levels of No. 1 are said to average as well as the Tamarack, the rock being softer and better mineralized below the 18th level. Water is forked from the conglomerate openings by a Cornish pump with 10″ lift, the largest of this style in the Lake district, which probably is handling water as cheaply per foot-gallon as any pump in Michigan. The combination shaft-rockhouse is 40x50′ on the ground, and 96′ high.

No. 2 shaft, 1,200′ south of No. 1, is 7′x18′ 4″ over all, and 1,200′ in depth. It is sunk 3′ under the footwall, to secure firm walls. The rock averages better than in No. 1, and the bottom levels are the best of the mine. The equipment includes a temporary shaft-rockhouse and straight-drum duplex-cylinder hoist, brought from No. 1 Amygdaloid shaft, good for 2,000′ depth. It is planned to build a large shaft-rockhouse and install a new double-drum hoist good for 3,000′ depth. In addition to the two shafts already opened, the Franklin Junior tract has room for two additional shafts, one each to the north and south of the present openings. The conglomerate lode averages 18′ to 22′ width, with an extreme width of 30′, and 3′ to 5′ of lode-rock is left unmined on the hanging-wall, and no rock assortment attempted. The conglomerate is more regular in its copper contents than to the northward, where it is very bunchy at the old Allouez mine.

In addition to the Allouez conglomerate and Pewabic amygdaloid, the Franklin Junior tract carries the Mesnard epidote, Calumet conglomerate and Osceola and Kearsarge amygdaloids, all supposed to have been opened by a 975′ crosscut sent west from the fourth level on the Pewabic lode, this showing several amygdaloids, and one conglomerate carrying copper in unpromising quantities. The formation is found considerably disturbed at that depth, and a deeper crosscut may be driven eventually. Later developments to the northward having shown the Kearsarge amygdaloid to carry good values to within a mile or two of the Franklin Junior boundary, it was decided to test this bed on the Junior tract. Dr. L. L. Hubbard estimates, on data furnished by R. C. Pryor, that the Kearsarge amygdaloid should lie 1,308′ horizontally east of the Allouez conglomerate, which would indicate that the old 975′ crosscut, driven 1894, did not reach the Kearsarge lode. The crosscut, in consequence, is being extended eastward. Diamond drill borings lead to the hope that the Kearsarge bed may be found workable on the Franklin Junior lands.

Surface equipment at the Franklin Junior mine includes substantial and well-equipped machine, carpenter and blacksmith shops, engine-houses, boiler-houses, air-compressors of 10, 12 and 36 drill capacity, office, warehouse, dry-house and a considerable number of new and rebuilt dwellings for employes.

The stamp-mill, at Grosse Pointe, is served by the Mineral Range railroad. The building is of steel, on stone foundations, 177x194′ in size, and has a self-supporting brick-lined smokestack of 7′ diameter and 165′ height, standing on a 52′ brick foundation. The mill has four Allis-Chalmers two-way heads, with 20x24″ cylinders, each treating an average of about 350 tons daily, equal to crushing 500 tons of softer amygdaloid rock. Each head has a 1,000-ton rock-bin, and is equipped with hydraulic separators, which take out considerable heavy copper. Each head has 20 rough jigs, 15 finisher jigs, round tables, and one Overstrom table. The jigs are of the Hodge eccentric type, with center-shield copper discharges, which obviate skimming. Foundations are being built for a fifth head, which should be in commission late in 1906. As soon as the fifth head begins stamping, the

foundations of two old heads will be rebuilt. The mill has a 16x22″ Allis-Chalmers engine, with steam supplied by two 500-h. p. Stirling water tube boilers. Water is furnished by an Allis-Chalmers 15,000,000-gallon vertical compound pump, with 12x42″ high-pressure cylinders and 42x42″ low-pressure cylinders, with 42″ stroke and plungers 37.5″ in diameter. Water is drawn through a 36″ pipe-line running 200′ into the lake, to a crib, protected by ¼″ screens. The mill has a 5x12″ duplex fire-pump with a full outfit of hose, and a complete electric light plant. There is a 267′ wharf at the millsite, with 18′ of clear water alongside, this having coal-hoists and coal-sheds. There are about 20 dwellings at the millsite.

The mines are running 35 power drills at the Junior and 15 at the old Franklin, which produce about 1,400 tons of stamp rock daily, coming 300 tons from the old mine, 650 tons from No. 1 Junior and 450 tons from No. 2 Junior shaft. The Junior mine has about 30 mouths of advance openings and is being developed systematically, by drift-stopes, which are carried about 12′ high and to the full width of the payable ground. Production, 1904, was 4,771,050 lbs. and 1905 was 4,206,085 lbs. fine copper. Earnings for 1905, including estimated value of copper on hand at end of year, were $642,518.46, and expenditures were $668,076.30, giving a net loss of $25,557.84 on the year's operations. Production of 1905 would have been larger but for a strike. The average returns from rock stamped in 1905 was but 11.25 lbs. fine copper per ton, rendering the Franklin the lowest grade copper mine now worked in the world. Mineral is dressed very low, averaging about 50% copper only. Under the capable management of Mr. R. M. Edwards, the property is being developed systematically and extensively. The property is so low in grade that the only possibility of rendering it successful lies in producing upon a very large scale, with every economy in both mining and milling.

FRASER MOUNTAIN COPPER CO. **NEW MEXICO.**

Office: Asbury Park, N. J. Mine office: Twining, Taos Co., N. M. Lands, 400 acres, partly patented, also a 7-acre millsite and 800 acres miscellaneous lands, in the Rio Hondo district, carrying 3 fissure veins partly developed, main vein being 50′ to 60′ wide and traceable 1,000′, showing oxide, carbonate and sulphide ores. Development is by several shallow shafts and 6 tunnels, with about 2,000′ of workings. Equipment includes a water-wheel, air-compressors, electric lights, shops, hotel and a general store. Has a 100-ton concentrator and a 125-ton smelter. Ores are claimed to average 4% copper, with good gold and silver values. Company was wrecked by the rascality of its management, and was sold at auction, 1905, but was bid in by a trustee for former shareholders, with a view to possible reorganization. Property thought to be of value, if properly developed and honestly managed.

FREE CUBA MINE. **CALIFORNIA.**

Office and mine: care of Ira L. Houser, owner, Acton, Los Angeles Co., Cal. Mine, opened circa 1860, has a quartz vein 23′ wide, with a 5′ paystreak carrying native copper and high grade ore. Has steam power. Idle.

FREEHOLD MINE. **AUSTRALIA.**

Mine office: Newellton, Queensland, Australia. Has ores assaying 10%

to 30 % copper and 12 oz. to 30 oz. silver per ton. Presumably idle.

FREELAND CONSOLIDATED MINES CO. **COLORADO.**

Succeeded, 1904, by Freeland Development & Transportation Co.

FREELAND DEVELOPMENT & TRANSPORTATION CO. **COLORADO.**

Office and mine: Idaho Springs, Clear Creek Co., Colo. J. R. McKinnie, president; Geo. E. Armstrong, secretary and treasurer; Geo. McClelland, general manager. Organized May, 1904, under laws of Colorado, with capitalization $5,000,000, shares $50 par. Lands, 130 claims, mainly patented, area upwards of 500 acres, also 30 acres of mill and smelter sites. Property was opened in 1861, and is extensively developed on fissure veins in granite, having produced upwards of $5,000,000 in gold, silver, copper and lead, copper occurring as chalcopyrite. Ore is divided into two classes, of which the smelting ore has averaged $35 net returns and the milling ore $12 in values. The McClelland tunnel, 3,600′ in length, will drain, ventilate and develop all the principal properties of the company, to depths of 1,300′ to 3,000′, and also connect them with the Colorado & Southern railway, which runs through the company's lands. Employed 20 men, at last accounts.

FREELAND EXTENSION MINING & MILLING CO. **COLORADO.**

Mine office: Idaho Springs, Clear Creek Co., Colo. Jas. A. Wilson, superintendent. Ores carry gold, silver, lead and copper. Has gasoline power. Presumably idle.

FREELAND MERCANTILE & MINING CO. **COLORADO.**

Dead.

FREMONT COPPER MINING CO. **WYOMING.**

Office: Fremont, Neb. Letter returned unclaimed from former mine office, Riverside, Carbon Co., Wyo. Thos. Carroll, secretary and superintendent. Lands, in Purgatory Gulch, are opened by a 225′ incline shaft, from which ore giving good assays has been secured. Has steam power. Presumably idle.

FRENCH CREEK MINES. **PENNSYLVANIA.**

Old and idle copper mines in Chester county, Pennsylvania.

FRESNO COPPER CO., LTD. **CALIFORNIA.**

Office: 188, St. Vincent St., Glasgow, Scotland. Mine office: Clovis, Fresno Co., Cal. John H. Graham, J. P., chairman; H. Grafton Vercoe, managing director at mines; J. M. Murray, secretary. Organized April 2, 1902, with capitalization £400,000, shares, £1 par; issued, £377,477. Lands, 480 acres in fee and 1,880 acres under option, near Pollasky, carrying a vein claimed to be 50′ wide, on which 4 shallow shafts show ores assaying up to 7% copper and $2 gold per ton. In 1905 was building a smelter with 2 small furnaces and a converter plant. New manager is said to have disposed of bulk of his personal shares, and the company does not seem to have made a very profound impression in California.

FRIDAY & LOWDEN. **CALIFORNIA.**

Office and mine: Redding, Shasta Co., Cal. Lands are a group of prospects, slightly developed by tunnels. Idle.

SILBER- UND BLEIERZBERGWERK FRIEDRICHSSEGEN AKTIEN-GESELLSCHAFT. **GERMANY.**

Mine office: Friedrichssegen an den L., Hessen-Nassau, Germany. Max Rosenthal, president; C. Leuschner, superintendent. Production, 1903, was 380 metric tons of argentiferous lead ore, carrying 62.43% lead and 46.93 grams silver per ton; 5,524 metric tons of zinc ore, averaging 46.31% zinc; 50.25 tons of spathic iron ore, and 8 tons of copper ore averaging 12.1% copper and 11.64 grams silver per ton.

FRISCO CONTACT MINING CO. **UTAH.**

Office: 209 Dooly Blk., Salt Lake City, Utah. Mine office: Frisco, Beaver Co., Utah. Employs 10 men. D. P. Rohfling, president and general manager; Patrick Ryan, vice-president; H. S. Young, secretary and treasurer. Organized, circa 1903, under laws of Wyoming, with capitalization $1,000,000, shares $1 par. Lands, 18 claims, area circa 340 acres, in the Frisco district, near the Horn Silver mine, showing four contact veins between limestone and andesite, one ranging up to 180′ width, carrying ores that have given assays up to 20% copper, 45% lead, 3% zinc, 45 oz. silver and 80 cents gold per ton. Has 5 shafts, deepest 360′, and circa 600′ of tunnels, with about 2,000′ of underground openings. Has a steam plant, hoists of 50-h. p. and 80-h. p., and necessary mine buildings. Company plans sinking main shaft to depth of 800′, and drifting and crosscutting therefrom, at intervals of 100′.

FRISCO MINING CO. **UTAH.**

Title changed, circa 1903, to Frisco Contact Mining Co.

FRONTENAC COPPER CO. **MICHIGAN.**

Office: 12 Ashburton Place, Boston, Mass. Mine office: Calumet, Houghton Co., Mich. Quincy A. Shaw, Jr., president, Rudolph L. Agassiz, vice-president; James MacNaughton, general manager; preceding officers and F. W. Hunnewell, directors; Geo. A. Flagg, secretary and treasurer. Organized June 26, 1905, under laws of Michigan, with capitalization $500,000, shares $25 par. Annual meeting, in August. Is a subsidiary corporation of the Calumet & Hecla Mining Co., which owns the entire stock issue. Landed holdings are very extensive, amounting to 22,268 acres, in Keweenaw county, Michigan.

COMPAÑIA MINERA LA FRONTERIZA. **MEXICO.**

Mine office: Cerralvo, Nuevo León, Mex. Ores carry silver and copper. Employed about 25 men, at last accounts.

FUJITA-KUMI & CO. **JAPAN.**

Office: 180 Dojima-Kitamachi, Osaka, Japan. Mine office: Kosaka-mura, Kazuno-gori, Rikuchu, Japan. Denzaburo Fujita, chairman; Heitaro Fujita, vice-chairman; R. Tanaka, general manager; S. Saito, mine superintendent; K. Takenouchi, smelter superintendent. Organized 1875, under laws of Japan, with capitalization £6,000,000.

Property includes the Kosaka and Towada mines, located in the midst of high mountains difficult of access. The Kosaka is 10 miles from the government railroad. Country rock is brecciated porphyry tuff, with intrusions of liparite and andesite, ore bodies occurring at the contact zone between the

tuff and andesite. Ore bodies occur as impregnations, ranging from 20′ to 270′ in width and from 300′ to 450′ in length, tested to depth of 480′ under the outcrop. There are five of these ore bodies, the ores giving average returns of 2.3% copper, 1.5% lead and 0.8% zinc, from complex silicious sulphide ores. Development is by 9 shafts of 221′, 159′, 159′, 159′, 159′, 159′, 159′, 120′ and 41′ and by 5 tunnels of 258′, 714′, 1,084′, 1,212′, and 2,080′. Mine, discovered 1860 and opened 1864, has been under the management of the present owners since 1884. The Kosaka, is, without doubt, one of the best copper mines in Japan, and one of the big copper mines of the world, with further developement. Power is generated by a turbine water-wheel, about 200 h. p. being used at the mine, 1,600 h. p. at the smelter and 200 h. p. for miscellaneous uses. Equipment includes two 8-drill Leyner air-compressors, 7 water Leyner power drills and 3 Gardner & Durkee electric drills. Improvements include a foundry covering 1,538 square yards, carpenter shop of 1,332 square yards, and boiler shop of 812 square yards, all of wood and brick.

The Towada mine, opened 1670, has a vein of 30′ to 100′ width, carrying disseminated auriferous chalcopyrite and argentite.

The smelter, one mile from the Kosaka mine, of 1,000 tons daily capacity, has 8 Herreshoff calcining furnaces, of which 6 are used on ore, one on matte and one on slags. There are 6 rectangular water-jacket blast-furnaces, of which 2 are used for matte smelting, 2 for anode casting, 1 for blister copper and 1 for ingot and cake copper. The plant presumably has an electrolytic refinery in connection, product being reported turned out as electrolytic copper of 99.95% tenor.

The company owns and operates two sawmills, and has 8 miles of private electric railroad, equipped with 10 electric locomotives and 400 three-ton ore cars. Fuel is bituminous coal, costing $6.80 per long ton, and coke for blast-furnaces costs $8 per long ton.

Production, 1905, was 9,238.42 oz. gold, 1,087,665 oz. silver and 13,984.768, lbs. fine copper, made from 311,413 long tons ore treated, giving average smelter returns of 2.3% copper, 3.5 oz. silver and 0.03 oz. gold per long ton. Estimated production for 1906 is 6,750 long tons fine copper. The property is under a progressive management, and production has been quadrupled in the past few years, with steady gains in output likely to continue for some years to come, the Kosaka being the most promising of the newer copper mines of Japan.

FUKADA MINE. **JAPAN.**

Mine office: Fukada-mura, Kuma-gori, Higo, Japan. Country rocks are alternate strata of sandstone and clay-slate of Paleozoic age, ore body having strike and dip corresponding to country rocks, and ranging 5′ to 10′ in thickness. Ore is chalcopyrite, associated with iron pyrites, and averages 5% to 6% copper. Production, 1900, was 18,266 lbs. fine copper only.

FULTON MINE. **NEW MEXICO.**

Letter returned unclaimed from former mine office, Ribera, San Miguel Co., N. M. Shipped several carloads of high-grade copper ore to smelter at Cerillos, 1902.

FUNATSU MINE. **JAPAN.**

Mine office: Funatsu, Hida, Japan. Has argentiferous copper ore and makes circa 500,000 lbs fine copper yearly.

COMPAÑIA MINERA FUNDIDORA y AFINADORA. **MEXICO.**

Office: Monterey, N. L., Mex. Mine office: Panuco de Coronado, Durango, Mex. Operates La Cruz y Anexas mines, producing silver, lead and copper. Employed an average force of about 50 men, at last accounts.

FURNACE CREEK MINING CO. **CALIFORNIA.**

Office: care of Patrick Clark, Spokane, Wash. Lands are sundry claims on Furnace Creek, near the Funeral Range, Death Valley, California, presumably in Inyo county. District is utterly arid, and all water is hauled in from a distance. It is expected that rail connection will be secured shortly.

DWIGHT FURNESS CO. **MEXICO.**

Office: Guanajuato, Mex. Mine office: Etzatlán, Jalisco, Mex. Dwight Furness, president; W. N. Cummings, manager. Lands include sundry groups of mines in the Etzatlán, Ameca and Hostotipaquillo districts of Jalisco, Mexico. The Santo Domingo group, 10 miles east of Hostotipaquillo, area 21 pertenencias, shows veins of 3′ to 10′ width, carrying gold and silver ores.

The Mina Grande group, 20 miles west of Hostotipaquillo, area 31 pertenencias, shows veins of 6′ to 50′ width, carrying native silver and gold, and sulphide silver ore. This property is fairly developed by shafts and tunnels, with considerable ore exposed.

The Casadas group, 25 miles west of Hostotipaquillo, area 21 pertenencias, shows veins of 3′ to 10′ width, carrying native gold and silver, and sulphide silver ore.

The Magistral y Anexas, 12 miles southwest of Ameca, area 24 pertenencias, shows a wide vein carrying paystreaks and chutes with workable values in argentiferous and auriferous oxide, carbonate and sulphide copper ores. Property is extensively developed by shafts and tunnels, but the ores of the oxidized zone are largely worked out, property having been operated extensively in the past, mainly for the production of copper sulphate and sulphuric acid.

The Calabaza group, 4 miles south of Etzatlán, area 24 pertenencias, shows 4 fissure veins of 4′ to 12′ width, carrying auriferous and argentiferous sphalerite and galena. Mine has 650′ of workings and is estimated to have 20,000 tons of ore in sight.

The Auga Blanca group carries auriferous copper ore and argentiferous lead ore. Some of the properties of this company are of considerable promise.

FURUKAWA MINING CO. **JAPAN.**

Office: Mitsu Bishi Bldg., Yayesucho, Kojimachi-ku, Tokio, Japan. Principal mine offices: Ashio, Shimotsuke; Innai, Akita; Rioshikaso, Echigo; Aniai, Ugo, Japan. Junkiche Furukawa, president; R. Kondo, general manager; M. Otagawa, assistant manager; K. Asano, consulting engineer. Is the largest copper producer of Japan, property including 15 copper mines, 3 silver mines and 7 coal mines, the Ashio, Ani, Kusakura, Innai and Kune mines being the principal copper producers.

The Ashio mine, in the province of Shimotsuke, discovered A. D. 1610, was developed by the Tokugawa government, reaching a productive capacity of 2,000,000 to 3,000,000 lbs. fine copper yearly, in the latter half of the Seventeenth Century, and as this output was in excess of the home demand, the surplus was exported to Holland. The property came into possession of the Furukawa company in 1877, in such poor condition that its yield was only about 400,000 lbs. of copper yearly, but by good handling and careful development, coupled with the introduction of the most approved methods and modern machinery, has been made the foremost copper mine of Japan. The country rocks are Paleozoic clay-slate, sandstone and hornstone, with liparite intrusions, numerous metalliferous veins traversing the liparite but thinning out in the Paleozoic rocks. The property has 7 main veins, averaging 6′ to 7′ in width, all with sharp dips and carrying a little bornite and melaconite in the upper levels, principal values being in chalcopyrite, associated with galena, sphalerite, arsenopyrite and iron pyrite, these ores having a quartz and clay gangue. The deepest mine openings are about 1,200′ and the ores give average smelter returns of about 4% copper, with small silver values. The nearest railroad station is Nikko, distant 9 miles over the mountains from Ashio. Supplies are brought in tram-cars, hauled by bullocks to the foot of the mountains, 5 miles from Nikko, and transported thence to the mine by two aerial trams, each about 19,500′ in length, with some very long and high spans, these crossing the crest of the mountains and descending on the other side to Ashio. Power for the aerial trams is furnished by a water plant, with Pelton wheel, near Ashio. There also is a horse-tramway, connecting the different mines and smelters. Steam, water and electric power are used, there being 5 electric plants, developing about 2,500-h. p., generated mainly from adjacent streams. Much of the ore is handled underground by electric haulage plants, and power drills are used extensively. The mine equipment includes modern machinery, mainly of American and German manufacture.

The Ashio has a 25-stamp mill and 3 concentrators, ore being put about 4 into 1, and sent to the smelter with an average copper tenor of 15%. A little high-grade ore goes direct to the smelters. A 750-ton smelter, completed 1904, has 3 water-jacket blast-furnaces, two converter stands, with 7 shells, a 40-ton traveling crane, silica-mill, blowers, air-compressors, and all other devices found in any thoroughly modern copper smelting plant. The Ashio mine alone employs about 12,000 people, including the forces at the copper mines, flux quarries, smelters, charcoal kilns, offices, etc. The forces include men women and children, the children and females being employed at light labor only. Wages, while low according to western standards, are much higher than the average in Japan, miners earning 40c. to $1 per day and smeltermen about 30c. per day, while engineers, carpenters, smiths and other craftsmen are paid 50c. to $1 per day, and boys and girls in the mills earn 10c. to 25c. per day. Production of the Ashio, 1904, was 14,622,000 lbs. copper, of 99% tenor.

The Ani group, at Aniai, province of Ugo, is a group of very ancient mines, recently modernized in plant and mining practice. Shigeo Kasai is mine manager. The Ani mines have auriferous, argentiferous and plumbiferous sulphide

ores of copper, considerable silver values being secured as a by-product. The mine has steam, water and electric power, with a very good modern plant, including a 10-stamp mill and a 150-ton smelter. About 2,500 hands are employed and the production, 1904, was 2,264,000 lbs. of 97 % blister copper.

The Kusakura mine, at Rioshikaso, province of Echigo, opened in the Eighteenth Century, was bought by the Furukawa company in 1870. S. Gamoh is mine manager. This property shows 4 nearly parallel main veins, traversing porphyry and andesite, and averaging less than one foot in thickness, though occasionally widening to several feet. The upper workings show bornite and cuprite, with principal values in chalcopyrite, associated with galena and iron pyrites in the lower levels. The mine has steam and electric power and a small smelter, employing about 1,000 hands. Production, 1904, was 1,650,000 lbs. of 98.5% blister copper.

The Nagamatsu mine at Okura-mura, Mogami-gori, Uzen, shows many veins, largest ranging from 6″ to 24″ width. Ore is chalcopyrite, associated with pyrite and occasional spahlerite, in quartz gangue. Production, 1904, was 620,000 lbs. of 98% blister copper.

The Furokura mine, at Kazuno-gori, Rikuchu, was discovered 1762, opened 1765, idle 1794 to 1868, when again reopened. Has numerous veins carrying chalcopyrite associated with iron pyrites, hematite and occasional sphalerite and galena, with a clay gouge, traversing Tertiary strata and andesite. Production, 1904, was 550,000 lbs. of 97% blister copper.

The Mizusawa mine, at Iwasaki-mura, Waga-gori, Rikuchu, has two 3′ veins at junction of granite and liparite, carrying chalcopyrite in quartz gangue. Production, 1904, was 296,000 lbs. of 97% blister copper.

The Kune mine, at Sakuma-mura, Iwati-gori, Totomi, was opened in 1726. The ore is chalcopyrite associated with iron pyrites, averaging 6% to 7% copper, occurring in three beds, the upper 100′ thick, the middle 12′ and the lowest 6′ in thickness, the latter splitting into two 2′ seams at the bottom. Production, 1898, was 137,686 lbs. fine copper.

The Otori mine made 187,000 lbs. fine copper in 1904.

The management of the Furukawa Mining Co. is not only one of the most progressive in Japan, but justly ranks with the most progressive engaged in the copper industry in any part of the globe. The responsible heads of departments are encouraged to travel through the mining and metallurgical centers of America and Europe, and as a result of the frequent visits of trained engineers, to all the leading mining centers of the world, the Furukawa company is enabled to keep fully abreast of international progress in every branch of its business. The enlightened policy followed by this company is one that might be followed, with decided advantage, by almost any great mine in any other country. Production, 1905, was 23,780,573 lbs. fine copper.

FUROKURA MINE. **JAPAN.**

Owned by Furukawa Copper. Co.

FUTURITY MINING & MILLING CO. **COLORADO.**

Letter returned unclaimed from former office, 370 Bennett Ave., Cripple Creek, Colo. Mine office: Newett, Chaffee Co., Colo. H. S. Smith, president

Geo. L. Breithaupt, secretary and manager; Leo E. Breithaupt, superintendent. Has a 352′ shaft, developing ores carrying gold, copper and silver. Has steam power.

COMPAÑIA GADITANA DE MINAS. **SPAIN.**

Office: Cadiz, Spain. Mine office: Aznalcóllar, Sevilla, Spain. Capitalization, 3,000,000 pesetas, shares 500 pesetas par; debentures, 2,000,000 pesetas authorized. Marquis de Fiel Pérez Calixto, president; Don José Luis Lacave, treasurer; Don Salvador Viniegra, secretary. Property is La Caridad group of mines, carrying large bodies of cupriferous iron pyrites, with considerable development, and in order to furnish shipping facilities for its product, the company has built a railroad of 34 kilometres from Aznalcóllar to the Guadalquivir river. Management is excellent, and property is regarded as of considerable promise.

CAGNON MINE. **MONTANA.**

Owned by Trenton Mining & Development Co.

GALAHER MINING & MILLING CO. **WASHINGTON.**

Office: care of Edward Peterson, managing agent, 705 First Ave., Seattle, Wash. Mine office: Cle Elum, Kittitas Co., Wash. Organized under laws of Washington, with capitalization $2,000,000, shares $1 par. Lands, 10 claims, area 200 acres, showing copper ledges, also a vein of cinnabar of about 1% only in tenor. Development is by a 70′ shaft on the Copper King claim, and by tunnels of 380′ on the Last Chance, 310′ on the Copper Prince, 128′ on the Navidad and 120′ on the Dolphin. Company claims a 3′ vein of bornite in the Legal Tender, a 4′ vein on the Last Chance, and a 3′ vein on the Copper King. About $15,000 has been expended on development.

GALENA COPPER MINING CO. **WASHINGTON.**

Office: 115 Marion St., Seattle, Wash. L. E. Rader, president; H. M. Williams, vice-president; John M. Snook, secretary; F. X. Waldron, treasurer; F. L. Horning, auditor; Judson C. Hubbart, manager. Organized 1904, under laws of Washington, with capitalization $1,000,000, shares $1 par. Lands, presumably in the Silver Creek district of Snohomish county, Washington, are claimed to have given ores assaying 18.5% copper, 2.9 oz. silver and $1 gold per ton. Development is claimed to be by tunnel, and management is said to be good.

GALENA MINE. **BRITISH COLUMBIA.**

Mine office: Britannia Beach, B. C. J. H. Scott, manager. Lands, sundry claims on Howe Sound, about 6 miles south of the Britannia mine, located one-half mile from tidewater, opened by a 100′ tunnel on a 5′ vein of copper ore.

GALENA MINE. **MONTANA.**

Mine office: Norris, Madison Co., Mont. D. A. Clapp, manager, at last accounts. Ores carry gold, silver and copper. Presumably idle.

GALENA RIDGE MINING CO. **WYOMING.**

Mine office: Meteetse, Big Horn Co., Wyo. Lands, circa 1,200 acres, patented, also timber lands and water-rights. Property has five veins of good width, on one of which the 450′ Oregon tunnel shows ores carrying copper, lead, silver and gold values, with quartz gangue. Small sample shipments to Denver are said to have given good returns. Development is by a 1,400′ cross-

cut tunnel, planned to be driven about 5,000′. Has a Pelton water-wheel and 10-drill air-compressor.

GALIZURSKI WORKS. **RUSSIA.**

Located in the government of Elizabethpol, Russia. S. Varavov, owner. Production, 1899, was 1,390,095 lbs. fine copper.

GALLATIN COPPER BASIN COPPER MINING CO. **MONTANA.**

Organized January, 1906, under laws of Montana, with capitalization $100,000, to engage in mining in Gallatin county, Montana.

GALLATIN MINE. **MONTANA.**

Owned by Anaconda Copper Mining Co.

GAP MINE. **PENNSYLVANIA**

An old and idle property, in Lancaster county, Pennsylvania, which, until closed, 1903, was the principal American producer of nickel, making some copper as a by-product.

GARDINER, WORTHEN & GOSS CO. **ARIZONA.**

Office and works: Tucson, Pima Co., Ariz. B. L. Worthen, general manager. Has a smelter with 30-ton experimental water-jacket blast-furnace, burning crude California petroleum, tests of which are said to have been satisfactory. Presumably idle.

GARDNER HILL MINE. **NORTH CAROLINA.**

An old and idle mine at Jamestown, Guilford county, North Carolina, opened by a 110′ shaft, showing cupriferous iron pyrites in 3 veins, ranging from a few inches to 3′ in width.

COMPAÑIA MINERA GARDUNA y ANEXAS. **MEXICO.**

Mine office: Placeres del Oro, via Cayuca de Catalán, Guerrero, Mex. Was worked originally for gold, but now has copper, and plans building a small matting furnace.

GARFIELD MINING CO. **UTAH.**

Letter returned unclaimed from former mine office, Brigham, Utah.

GARLOCK MINE. **CALIFORNIA.**

Mine office: Garlock, Kern Co., Cal. E. T. Garlock, superintendent. Has steam power and a 10-stamp mill. Presumably idle.

GARRISON GOLD & COPPER MINING CO. **UTAH.**

Dead. Lands were near Ibapah, Toele county, Utah.

GAVILANES MINING & MILLING CO. **MEXICO.**

Office: 819 Chamber of Commerce, Chicago, Ills. Mine office: Gavilanes. Durango, Mex. C. A. Wightman, president; John A. Boland, secretary and treasurer; James E. Boland, manager. Organized Sept. 1, 1904, under laws of Arizona, with capitalization $2,000,000, shares $1 par. Lands, 500 acres of mineral territory and 30,000 acres of timber and grazing lands, also water-rights to 10 miles of the Piaxtla and Pilar rivers. Lands, include the old Gavilanes silver mine, a property that has produced, according to official records, 80,000,000 ounces of silver, also sundry undeveloped copper veins.

GEIGER MINE. **COLORADO**

Mine office: Apex, Gilpin Co., Colo. Ores carry gold, silver, lead and copper. Has steam power.

SUCESION FRANCISCO GEISSE. **CHILE.**

Office and mines: El Espino, Combarbalá, Chile. Operates El Espino mine, opened 1896, making about 100,000 lbs. fine copper yearly.

GEISSE HERMANOS. **CHILE.**

Office and mine: Illapel, Coquimbo, Chile. Operate copper mines, opened 1875, making a circa 300,000 lbs. fine copper yearly.

ALFRED W. GEIST. **MEXICO.**

Office: Guadalajara, Jalisco, Mex. Mine office: Cuale, Jalisco, Mex. Lands, 5 miles from Cuale, include El Creator and El Favor mines, showing large ore bodies, extensively opened by antigua and modern workings. Ores are argentiferous and auriferous sulphides of copper, lead, zinc and iron. Property has water power. Reduction plant includes roasting furnaces, crushing machinery and an extensive patio.

LUIS L. GELABERT y CA. **PERÚ.**

Office and mine: Otoco, Lucañas, Perú. Firm is a small producer of gold, silver and copper ores.

GEM TURQUOISE & COPPER CO. **NEW MEXICO.**

Office: 37 Maiden Lane, New York. Mine office: Silver City, Grant Co., N. M. Property is a turquoise mine, in the Burro Mountains.

GEMINI MINING CO. **UTAH.**

Office: Salt Lake City, Utah. Mine office: Eureka, Juab Co., Utah. John Q. Packard, president; E. W. Packard, vice-president; J. E. Berkeley, secretary; L. S. Hills, treasurer; Jackson C. McChrystal, general superintendent. Mine shows a 20′ vein of argentiferous and auriferous copper ore, assaying 3% copper, on the 1,600′ level. Has steam and water power, with a good mining plant. Is a small but steady producer of gold, silver and copper, and has paid dividends of $300,000.

GENERAL DEVELOPMENT CO. **MONTANA.**

Office: 42 Broadway, New York. Mine office: Butte, Silver Bow Co., Mont. Adolph Lewisohn, president; J. H. Susmann, secretary and treasurer; J. Parke Channing, consulting engineer. Is controlled by the Lewisohn interests. Organized 1906, under laws of Delaware, with capitalization $250,000, shares $100 par; $25 paid in. Was organized for the purpose of purchasing and developing promising mining properties. Present holdings include the Altoona group, in the eastern part of Butte, held under a $100,000 bond, on which unwatering and reopening was begun early in 1906. Principal development is by an old 400′ shaft, on the Amazon claim.

GENERAL ELECTRIC MINE. **ARIZONA.**

Mine office: Clifton, Graham Co., Ariz. Idle at last accounts.

GENERAL GRANT MINING CO. **COLORADO.**

Letter returned unclaimed from former mine office, Pemberton, Colo.

GEORGE THIRD MINING, MILLING & SMELTING CO. **COLORADO.**

Letter returned unclaimed from former mine office, Carson, Colo.

GEORGETOWN GOLD MINING CO. **COLORADO.**

Mine office: Georgetown, Clear Creek Co., Colo. Frank B. Branham, superintendent. Ores carry gold, silver, lead and copper.

GEORGIA & TENNESEE COPPER CO. **GEORGIA & FLORIDA.**

Office: care of H. G. Brooks, 35 Congress St., Boston, Mass. Mine office: Temple, Haralson Co., Ga. Employs 6 to 10 men. Theo. Sutro, president; Otis Kimball, vice-president; Wm. Tudor, treasurer; preceding officers, L. V. Briggs and Jefferson Coolidge, Jr., directors; H. M. Mansfield, superintendent. Organized January 24, 1905, as successor of the Tallapoosa Copper Mines and Georgia Pyrites Co., with capitalization $1,000,000, shares $5 par. Annual meeting, second Tuesday in January. Lands, 447 acres of copper lands, in Georgia, and 800 acres of phosphate lands, in Marion and Levy counties, Florida, latter estimated to carry 800,000 tons of phosphate. Copper lands show country rocks of Laurentian schists, with 2 contact veins of 4′ to 19′ width, between slate and sandstone, opened by a 300′ shaft. Has 1,250′ of workings, estimated to show 85,000 tons of ore, with 45,000 tons blocked out for stoping, giving average assays of 3% copper, 2.7 oz. silver and $2 gold per ton. Ore is chalcopyrite, disseminated in pyrites, with an average sulphur content of 41%. Company plans installing an acid plant and manufacturing superphosphate for fertilizer.

COMPAGNIE DES MINES DE CUIVRE ET DE PLOMB DE GERONA. **SPAIN.**

French incorporation of Gerona Copper & Lead Mines, Ltd.

GERONA COPPER CO., LTD. **SPAIN.**

Voluntarily wound up, February, 1903.

GERONA COPPER & LEAD MINES, LTD. **SPAIN.**

Offices: 19, Queen Victoria St., London, E. C., Eng. Letter returned unclaimed from former mine office, Susquead, Gerona, Spain. Cecil A. Escott, chairman; Albert H. Greenhill, secretary. Organized, August 1, 1900, with capitalization £80,000, shares £5 par; issued, £50,050. Lands, 17 copper and lead mines, bought for £50,000 in shares. Idle for some years, and apparently moribund.

GERONIMO COPPER MINING CO. **NEW MEXICO.**

Letter returned unclaimed from alleged mine office, Silver City, Grant Co., N. M., with notation by the postmaster that the whole thing is a fake. Company apparently was promoted by the Financial Security & Trust Co., with supposed capitalization of $1,500,000, shares $1 par. Alleged property was claimed to be old mines, circa 8 miles, northwest of Silver City.

GERTRUDE MINE. **ONTARIO.**

Owned by Lake Superior Power Co.

GERTRUDE MINING CO. **WYOMING.**

Succeeded by Eagle Copper Co.

GEYMAN MINING CO. **MONTANA.**

Mine office: Butte, Silver Bow Co., Mont. Lands are a small tract northeast of the Parrot smelter, on which a shallow shaft has been sunk.

GIANT CHIEF MINING CO. **UTAH.**

Lands, in the Bingham district, are said to have been sold, circa April, 1906, to Willard F. Snyder, et al.

GIANT GOLD & COPPER MINING CO.

Letter returned unclaimed from former office, La Crosse, Wis.

GIANT LEDGE GOLD & COPPER CO. **COLORADO.**

Office: 500 Frost Bldg., Los Angeles, Cal. Mine office: Manvel, San Bernardino Co., Cal. L. M. Gregory, president and general manager; H. G. Stoddard, secretary; R. W. Kenny, treasurer; Edward Brough, mine superintendent. Organized July, 1901, under laws of Arizona, with capitalization $1,000,000, shares $1 par. Lands, 30 claims, also a 40-acre millsite and miscellaneous lands, with total area of upwards of 800 acres, in the New York district, showing 4 veins, of which 2 are being developed, one being a fissure in granite, and the other a contact vein between limestone and granite, with average width of 100′, giving average assays of 5% copper, 5% lead, 10 oz. silver and circa $4.50 gold per ton, from carbonate and oxide ores near surface and sulphides at depth. Has one shallow shaft and 2 tunnels, with about 4,000′ of underground workings, developing a considerable amount of ore. Management plans shipping ore to the new custom smelter at Needles. Company has no debts, and is developing conservatively. Management and property considered good.

GIANT MINING CO. **BRITISH COLUMBIA.**

Mine office: Rossland, Trail division, Yale district, B. C. Ores carry gold and copper. Has steam power. Idle.

COMPAÑIA MINERA LA GIBOSA y ANEXAS. **MEXICO.**

Dead. Property now held by American Smelters Securities Co.

GIBRALTAR COPPER MINING CO. **WYOMING.**

Office and mine: Encampment, Carbon Co., Wyo. Wm. L. Sill, president; Chas. E. Winter, secretary. Has a 4′ vein, opened by a 75′ shaft, showing ore giving assays up to 20% copper, with good gold and silver values. Has steam power. Presumably idle.

GIBSON COPPER CO. **ARIZONA.**

Office and mine: Globe, Gila Co., Ariz. Employs 60 men. S. L. Gibson, president, treasurer and general manager; Wm. Henderson, vice-president; Delos Copeland, secretary. Organized 1906, under laws of Arizona. with capitalization $2,500,000, shares $25 par; issued, $2,000,000.

Lands are 19 claims, area 380 acres, 5 surveyed for patents, circa 15 miles from Globe. Country rock is Pinal schists, with occasional trachyte, diorite, quartzite and porphyry, showing 20 or more veins or lenses, occurring as fissure veins in schists, and as contact veins between schists and porphyry. Main vein ranges 4′ to 7′ in width, and has been traced 2 miles. Development is by shafts of 80′, 120′ and 285′, and by tunnels of 120′, 578′, 650′, 680′ and 730′, giving a total of about one mile of workings, estimated to put 125,000 tons of ore in sight, with 75,000 tons blocked out for stoping. Ores are exclusively sulphide, and are almost entirely bornite and chalcopyrite, of extremely high grade, running 20% to 40% copper. Ore occurs massive and frequently is coated with chalcocite. Main shaft shows bornite on the 100′ level, and is bottomed, at 285′, in massive chalcopyrite. It is planned to deepen the main working shaft to 700′, and drift therefrom. Has 2 hoists, good for 500′ depth each,

and is installing a new mining plant, including a 280-h. p. boiler, 60-h p. engine, air-compressor, pump, power drills, etc. It is planned also to sink the second shaft to a depth of 500′. Fuel used is distillate and wood. Production, from May 1, 1904, to May 1, 1906, was $253,194.43, from ore averaging 20% in tenor, shipped by teams to the Old Dominion smelter.

The Gibson is a property of great promise, and has accomplished what rarely is done by a copper mine. Its owners begun work with a cash capital of $90, and on that foundation have built up a magnificent property, and from the net earnings of the mine have drawn out fully $75,000 in cash for other investments. Management is good, and the property will be heard from prominently in the future.

GILA MONSTER COPPER CO. **ARIZONA.**

Mine office: Kelvin, Pinal Co., Ariz. Thos. Rutledge and E. P. Grindell, superintendents, at last accounts. Lands include the Confidence mine, with circa 1,000′ of underground openings, showing auriferous and argentiferous bornite, chalcocite and sundry oxidized ores. Property is considered promising. Idle.

GILA PINAL MINES CO. **ARIZONA.**

Promoter dead and company probably ditto.

GILA VALLEY COPPER CO. **ARIZONA.**

Mine office: Safford, Graham Co., Ariz. Floyd H. Wilson, president; J. F. Webber, manager. Organized 1905, as successor to the Federal Mining Co., name being changed back to the old title, and former officers put in the penitentiary, to remove the stench of the Qualey management. Lands, 24 claims, area 470 acres, also a 5-acre millsite, including the San Juan and Great Eastern groups, in the Lone Star district, Gila Mountains, showing three ore bodies, of about 9′ average width, carrying oxide and carbonate ores above and sulphide ores below the 300′ level. Mine is opened by shafts of 130′, 325′ and 425′, and by tunnels of 90′, 100′ and 300′. Three shipments of ore, aggregating 75 tons, gave smelter returns of 24%, 28% and 30% copper, with about 2 oz. silver and 80c. gold per ton. Early in 1906 was erecting a 50-ton concentrator.

GILBERT & NORRIS. **MEXICO.**

Mine office: Zacatecas, Zac., Mex. Mine is opened by shaft and tunnels and has gasoline power. Employed 40 men at last accounts.

GILCHRIST & DAWSON, INC. **NEW MEXICO.**

Mine office: Fierro, Grant Co., N. M. J. D. Gilchrist, general manager. Company operates the Iron Head and Republic mines, producing mainly iron ore, with a little copper ore. Has steam power.

GILES GOLD MINING & MILLING CO. **COLORADO.**

Mine office: Ward, Boulder Co., Colo. H. F. Llewellyn, superintendent. Ores carry gold, silver and copper. Has steam power and a 10-stamp mill.

GILNOR BELLE MINE. **ALASKA.**

A property of considerable promise, in the Copper River district of Alaska, about 170 miles inland from Valdez, At last accounts was said to be under bond to George Mitchell.

GYPSY BLAIR MINING CO. **UTAH.**

Lands sold, 1905, to Kennebec Mining Co.

GIRARD MINE. **MICHIGAN.**

Sold, 1905, to Keweenaw Copper Co.

GIRILAMBONE COPPER MINING CO., LTD. **AUSTRALIA.**

Succeeded by Girilambone Mining Co. (No liability.)

GIRILAMBONE MINING CO. (NO LIABILITY.) **AUSTRALIA.**

Office: Sydney, N. S. W., Australia. Mine office: Girilambone, Cambelego Co., N. S. W., Australia. G. A. Richards, manager; W. Blakemore, mine manager. Employs circa 200 men. Ores are slightly argentiferous oxides, carbonates and sulphides, in a gangue of arenaceous slates, with numerous quartz veins and inclusions. Ores occur as disseminations and replacements, lacking the defined limits of ordinary fissure veins, in slate and sandstone country rocks having occasional hard bands of quartzite. Alteration zone extends down about 200′. Deepest shaft, 520′. Ores are divided into three classes for treatment, the first class comprising carbonates (including cuprite), with average assay value of 4.6%. Oxides from the transition zone make the second grade, and sulphides from the lower workings constitute the third class, each being smelted separately. Reduction is greatly hampered by deficiency of ore in sulphur and iron, and excess of silica. Water supply is very scant, causing trouble in times of drought. Mine has a dam and is compelled to filter and re-use the water repeatedly. Has a 250-ton smelter, with 5 reverberatory furnaces and one refining furnace, product being turned out as blister copper of the remarkable purity of 99.95%. The reduction plant includes a lixiviation plant, for leaching certain classes of oxide and carbonate ores.

GIROUX CONSOLIDATED MINES CO. **NEVADA & MEXICO.**

Office: 42 Broadway, New York. Mine offices: Ely, White Pine Co., Nev., and Carbo, Ures, Sonora, Mex. Joseph L. Giroux, president; Eugene L. Giroux, vice-president; G. E. Giroux, secretary; J. C. Kennedy, treasurer; J. A. Snedaker, consulting engineer; Lorren M. Hart, counsel; preceding officers, Conrad Dietz, Guy E. Giroux and Josiah Marvel, directors; Wm. R. Bassett, business manager; Gideon L. Giroux, superintendent. Employs circa 300 men, of whom 225 are at the Mexican mines. Organized under laws of Delaware, with capitalization $5,000,000, shares $5 par.

Lands are 1,287 acres, in two groups, one group, of 96 pertenencias, area 237 acres, being in the Ures district of Sonora, Mexico, and one group, area 1,050 acres, lying in the Ely district of Nevada. The Mexican claims, including the San José and Sultana mines, and commonly known as the Sultana group, lie in the Sierra de Oro Mountains, about 25 miles east of Carbo and circa 35 miles from Hermosillo. This property shows a lime-porphyry contact vein of 50′ to 100′ width, opened by 3 shafts, with about one mile of underground workings. Sultana No. 1 shaft is 200′ deep; Sultana No. 2, the main working shaft, sunk on an incline, is 1,075′ deep, and San José shaft is circa 500′ deep, and bottomed in a 40′ vein with considerable ore blocked out. The Sultana group as a whole shows ores of 3% to 4% in copper

tenor, with variable gold values, latter ranging from very small to very large, with a good proportion of high-grade ore. Smelter shipments of Sultana ore to El Paso have given combined gold and silver values ranging from 92 cents to $734.36 per ton, and Sultana shipments of April, 1906, amounting to 472 tons, returned $92,151 in values, giving an average gross return of $194.41 per ton.

The Nevada properties are the more important, and are of considerable promise. These lands lie immediately west of the Nevada Consolidated. The first series of ore measures are on the contact between plutonic and sedimentary rocks, the latter showing enormous areas of replacement by ore, with gangue of quartz, talc and clay. In places this series has been proven to a width of upwards of 1,000′, but the entire formation is not profitable. Measures of 100′ and upwards in width, of fair ore, have been opened.

The second series of ore measures is in the Giroux shaft, immediately above water-level, constituting a horizontal bed of oxidized ores of 30′ to 40′ thickness, said to average 7% or better in copper tenor.

The third series consists of a quartz-porphyry, which is a highly altered acid andesite, carrying upwards of 60% silica. The exposed surface has been leached to some extent, but at depths of 30′ to 40′, and below, to the depths yet tested, this porphyritic ore body, which in some respects is similar to that of the Bingham camp of Utah, carries ore values said to average 4% copper, in chalcocite, melaconite, and, at depth, chalcopyrite. The third series is in the plutonic area, which is estimated at 1,500x2,400′ on the Giroux property, with evidence leading to the opinion that the limits of the is mineralization, as now defined, may be considerably extended by further investigation.

Through this ground-mass of quartz-porphyry there are fissure veins varying from 3′ to 20′ in width, carrying ores claimed to average about 12% copper, 1 oz. silver and $6 gold per ton. These veins, or seams, show evidence of small faulting, and the ore deposits therein evidently are from mineral-bearing solutions coursing along the lines of least resistance. The quartz-porphyry, while lower in grade than the other occurrences of ore, contains infinitely so much more material that it must form the principal source of ore supply eventually. The ore is of a comparatively friable nature, and seems to present no unusual or complex problems in concentration. The vast extent of the ore body, and its occurrence in an immense mass, naturally have caused the management to give consideration to the methods to be followed in mining. While the present developments are on fissure veins, and these will be the first to produce, eventually the quartz-prophyry must be attacked, and it is probable that the plan of winning the ore will be a modification of the steam-shovel method, used so extensively at the iron ore mines of the Mesaba range, in the Lake Superior district.

Present mining development at the Ely mines is by shafts, of which there are eleven. The six principal working shafts have two compartments each, and are as follows: Giroux shaft, 800′: Alpha shaft, 650′: Taylor, Bunker Hill, Pilot Knob and Brooks shafts, 300′ each, at last accounts. It

is planned to sink the Giroux and Alpha shafts to 1,000′ depth each, as soon as practicable. The mines have about two miles of underground workings, and show some fair stopes. The leached zone, at and near surface, is followed by a zone of secondary enrichment, reaching to a depth of circa 375′, below which are unaltered sulphides. The zone of secondary enrichment shows considerable native copper, in addition to the usual oxides, carbonates and enriched sulphides. The 300′ level of the Giroux shaft shows a large ore body, claiming to range 7% to 15% in average copper tenor, and the average of the entire mine, as opened, is claimed to be better than 5% copper. Equipment is simple, but sufficient for development purposes, including 4 hoists, air-compressors, and necessary shops and mine structures.

A concentrator, rated at 500 tons daily capacity, is being built, and installation of machinery should begin during the latter half of 1906.

A contract has been let to the Colorado Iron Works Co. for a complete 250-ton smelter for the Nevada mines. The plant will include a 42x180″ water-jacket blast-furnace, blower, air-compressor, converter with one stand and 3 shells, etc., entire plant costing about $125,000. This was contracted for completion July 15th, 1905, but was not completed in May, 1906, and probably will not go into blast until the arrival of a railroad at Ely. The pressure from impatient shareholders always is very great in the case of a new mine, upon which large sums have been expended, but the conservative policy is the proper one in such a case, and many a good mine has been seriously handicapped by beginning production under disadvantageous circumstances.

In the two past editions of the Copper Handbook the Giroux company was censured for misleading statements put forth in its behalf, but it was stated that Mr. Joseph L. Giroux is a mining man of high standing, and the property was considered promising. It is with pleasure that the Copper Handbook is able to state, in its present edition, that a more conservative policy has been adopted.

GLADHAUGH MINE. **ALASKA.**

Mine office: Ellamar, Alaska. Property, on Prince William Sound, is opened to a depth of circa 500′, and some ore, giving returns up to 10% copper, has been shipped.

GLADSTONE MINE. **ARIZONA.**

Was held, at last accounts, by Ideal Mining & Development Co.

GLADYS MINING CO. **BRITISH COLUMBIA.**

Mine office: Alberni, Vancouver Isld., B. C. Property is opposite the Monitor mine, and across the Alberni Canal therefrom, and apparently has the extension of the Monitor vein, showing high-grade chalcopyrite.

GLASDIR COPPER MINES, LTD. **WALES.**

Voluntarily liquidated, October, 1903.

GLASDIR COPPER MINES (1903), LTD. **WALES.**

Offices: 4, Broad Street Place, London, E. C., Eng. Organized Oct. 17, 1903, with capitalization £1,000, shares £1 par, apparently as a tentative reorganization of the Gladsir Copper Mines, Ltd.

GLASGOW COPPER SYNDICATE, LTD. **CALIFORNIA.**

Offices: 149, St. Vincent Street, Glasgow, Scotland. T. & G. B. McKim & Cook, secretaries. Organized Dec. 14, 1904, with capitalization £8,000, shares £1 par, to acquire copper property in Fresno county, California.

GLASGOW & WESTERN EXPLORATION CO., LTD. **NEVADA.**

Offices: 33, Renfield St., Glasgow, Scotland, and 317 McCornick Bldg., Salt Lake City, Utah. Geo. McFarlane Reid, chairman; Otto Stallman, general manager; Jos. Farren, superintendent; George Cuthbert, secretary. Organized Oct. 28, 1896, with capitalization £30,000, shares £1 par. Manages and is the principal owner of the Adelaide Star Mines, Ltd.

GLEN-JENNINGS COPPER MINING CO. **WYOMING.**

Mine office: Encampment, Carbon Co., Wyo. Idle.

GLOBE & ARIZONA DEVELOPMENT CO. **ARIZONA.**

Mine office: Globe, Gila Co., Ariz. T. A. Pascoe, president; J. H. Hamill, vice-president; Chas. T. Martin, secretary; Chas. F. Solomon, treasurer; Pat Rose, superintendent. Capitalization $600,000, shares $10 par. Lands are sundry well located claims, adjoining the United Globe and Arizona Commercial Copper Co. Development is by a 65′ shaft, showing a 2′ vein of 12% ore, and a 180′ tunnel showing 16% ore.

GLOBE-BOSTON COPPER MINING CO. **ARIZONA.**

Lands sold, circa 1906, to Globe Consolidated Copper Co.

GLOBE CONSOLIDATED COPPER CO. **ARIZONA.**

Office: care of Henry B. Hovland, Duluth, Minn. Organized June, 1906, with capitalization $1,500,000, shares $10 par: issued, $1,000,000, $5 paid in. Lands are about 150 claims, area circa 3,000 acres, including the Globe-Boston property, a group of 21 claims near the Old Dominion and United Globe mines, bought for $130,000, the Mallory group, and other extensive holdings. The Globe-Boston property has considerable development, having a 465′ two-compartment shaft, showing a 4′ vein of low-grade chalcopyrite, with occasional bunches of bornite, both carrying fair silver values. Property is extensive, and the major portion of the holdings is excellently located. Management, which includes Messrs. Henry B. Hovland and Hoval A. Smith, who have been closely connected with the Calumet & Arizona group, since its inception, is good, and the property is considered one of much promise.

GLOBE COPPER MINING CO. **ARIZONA.**

Dead. Property now owned by Old Dominion Mining & Smelting Co.

GLOBE COPPER MINING CO. **WYOMING.**

Office: 24 Giddings Blk., Colorado Springs, Colo. Mine office: Hecla, Laramie Co., Wyo. A. C. Widdicombe, president; J. A. Morrison, vice-president and general manager; John H. House, secretary; Stewart Davis, treasurer; Prof. H. C. Beeler, consulting engineer. Organized 1901, under laws of Colorado, with capitalization $1,500,000, shares $1 par. Lands, 22 claims, area 438 acres, in the Silver Crown district, showing sundry fissure veins, of which 3, of 7′ average width, are opened by 5 shafts,

of 100′ average depth, and by tunnels of 90′ and 160′, giving estimated average values of 12% copper, 6 oz. to 10 oz. silver and $5 gold per ton, from sulphide ores. Has steam power and an air-compressor. Idle for several years.

GLOBE MINE. **MICHIGAN.**

Office: care of Copper Range Consolidated Co., 27 State St., Boston, Mass. Mine office: Painesdale, Houghton Co., Mich. F. W. Denton, superintendent. Property is owned by the estate of John Stanton, and is held under an option, expiring April, 1907, by the Copper Range Consolidated Co., which has paid $50,000 thereon, and it is understood that the option calls for the payment of 10,000 shares of new stock of Copper Range Consolidated, if the property is taken over. Property is Sections 1 and 2, Town 53 North, Range 35 West, carrying about 6,000′ of the strike of the Baltic lode, and adjoining parallel amygdaloid beds. The Champion mine lies next to the north, and the Challenge mine next to the south. The Copper Range company expended $54,000 in development work, to the end of 1905.

Diamond drill borings having shown ores carrying good copper values, it was decided to sink a shaft and open the mine. The overburden of sand and boulders is one of the heaviest in the Lake Superior district, hence it is necessary to reach the solid rock ledge by a vertical shaft, through an overburden about 250′ in thickness. Much trouble has been experienced in sinking the preliminary sand-shaft, and the system of sinking has been modified frequently, and changed radically from the plan on which started. The shaft, about 700′ south of the Champion boundary line, was about 150′ deep on May 1, 1906. The shaft is being sunk on a telescopic plan, the inside measurement of timbers, at the collar of the shaft, being 13′ 3″ x 23′ 3″, with inside measurement of the second section 9′ x 19′ 6″, and a third section will be still smaller. This plan will permit new inside timbering, and whatever realignment is required, when the shaft is bottomed. The shaft is being sunk with 64 steel shoes, each built with a water-jet having an opening of one square inch, and a water pressure of 300 pounds per inch. Weight of shoes is 37,000 pounds and these are pressed down by 6 hydraulic jacks, each exerting a pressure of 100 tons. The shaft is wet, making 800 gallons of water per minute, and progress is very slow.

The south drifts of the Champion mine, not far from the Globe boundary, are breasted in excellent rock, and there is every reason to anticipate the making of a fine mine from the Globe, but the preliminary work of reaching the solid rock ledge is certain to be tedious and costly, this being one of the deepest sand-shafts ever sunk.

GLOBE MINING CO. **ARIZONA.**

Office: 506–171 Washington St., Chicago, Ills. Mine office: Globe, Gila Co., Ariz. J. F. Hechtman, president and general manager; M. A. Patterson, vice-president; Geo. L. Beach, treasurer; Walter M. DeKalb, secretary. Organized February 19, 1903, under laws of Arizona, with capitalization $2,500,000, shares $1 par. Lands 27 claims, area 540 acres, including gold, silver and copper groups, nearest lying about 2½ miles from

Globe. Country rocks are granite-porphyry, syenite, quartzite and diorite, showing sundry fissure veins in diorite, running 2′ to 100′ in width, with iron cappings, giving assays of 2% to 6% copper, 4 oz. to 30 oz. silver and $2 to $28 gold per ton. The Mineral Farm group, of 18 full and 3 fractional claims, includes the Vacey-Constance mine, worked circa 1886, for silver, and having a 165′ shaft. The Mineral Farm group shows altered sedimentary and igneous rocks, with iron dikes and a complex fissure system. The Mineral Farm vein, of about 4′ width, gives assays of 4.8% copper and up to 132 oz. silver and $7.44 gold per ton. This property also shows a 20′ vein sampling 22% copper, 9% zinc, 2 oz. silver and $4.96 gold per ton. The group is said to have produced $100,000 in silver, under a former management. Miscellaneous holdings includes the Eagle Pass group. Property is considered promising.

GLOBE & PINTO MINING CO. **ARIZONA.**

Mine office: Globe, Gila Co., Ariz. A. T. Hammons, secretary. Organized circa 1905. Lands, 11 claims, lying north of and adjoining the Five Points group, opened by a 50′ shaft, claimed to show several thousand tons of ore, assaying 4% to 12% copper.

GLOBE TRACT.

Office: care of Estate of John Stanton, owner, 15 William St., New York. Property is Sections 3, 4, and 5, Town 53 North, Range 35 West, Houghton county, Michigan. From the original Globe tract the Globe mine, area 1,280 acres, has been set off, and is under option to the Copper Range Consolidated Co.

GLOBE WESTERN COPPER CO. **ARIZONA.**

Mine office: Globe, Gila Co., Ariz. L. G. Stewart, president and general manager; J. Weinberger, secretary. capitalization, $2,000,000, shares, $10 par. Lands include the Stewart & Clark group, near the Gibson mine, and the Cole & Goodwin group. The Stewart & Clark group is developed by a 250′ shaft, bottomed in high-grade sulphide ore, assaying 10% to 15% copper and upwards of 30% each in iron and sulphur. Shipments were begun to the Old Dominion smelter, April 19, 1906. Property is considered promising.

GEWERKSCHAFT VER. GLÜCKAUF-NEVIGES. **GERMANY.**

Mine office: Neviges, Rheinprovinz, Germany. Has lead and copper ores, developed by two shafts, and employed about 100 men, producing circa 12,000 tons of ore yearly, at last accounts.

GEWERKSCHAFT GLÜCKSBRUNN. **GERMANY.**

Merged, 1903, in the Eisfelder Kupfergewerkschaft.

GOAT CREEK MINING CO. **WASHINGTON.**

Mine office: Methow, Okanogan Co., Wash. John R. Cassin, manager, at last accounts. Ores carry gold, silver and copper.

GODIVA MINING CO. **UTAH.**

Mine office: Eureka, Juab Co., Utah. J. H. McChrystal, superintendent. Ores carry gold, silver and copper. Has steam power. Presumably idle.

A. GOERZ & CO., LTD. **GERMAN SOUTHWEST AFRICA.**

Offices: 20, Bishopsgate St., Within, London, E. C., Eng.; 26, Rue Lafitte, Paris, France; 8, Behrenstrasse, Berlin, W., Germany, and 4, Fraser St., Johannesburg, Transvaal, South Africa. Lord Battersea, chairman; Amandus Brakhan, Johnannesburg, chairman and joint managing director; Henry Strakosch, London, managing director; Henry Clark, secretary, London. Has extensive holdings in the Witwatersrand gold fields, also exclusive prospecting rights over 6,500 square miles in German Southwest Africa. Construction of a railroad line from the sea to Swakopmund is planned. Copper ores have been discovered at a number of points, in the district controlled by this company.

GOLD ANCHOR MINING CO. **COLORADO.**

Mine office: Alice, Clear Creek Co., Colo. Thos. I. Slater, manager. Ores carry gold, silver and copper. Has gasoline power.

GOLD BELT MINING CO. **MONTANA.**

Mine office: Empire, Lewis & Clark Co., Mont. Owen Byrnes, superintendent. Property includes the Empire and other mines, carrying gold, silver, lead and copper ores. Has steam power, 60-stamp mill and 500-ton cyanide plant, employing about 50 men, at last accounts.

GOLD BUG CONSOLIDATED MINING CO. **WASHINGTON.**

Mine office: Bossburg, Stevens Co., Wash. F. H. Merritt, superintendent, at last accounts. Ores carry gold, silver and copper.

GOLD BUG MINE. **COLORADO.**

Mine office: Empire, Clear Creek Co., Colo. N. B. Clough, superintendent, at last accounts. Ores carry gold, silver and copper.

GOLD & COPPER COMPANY OF BINGHAM. **UTAH.**

Succeeded, 1901, by Bingham Consolidated Mining & Smelting Co.

GOLD & COPPER CONSOLIDATED MINING & MILLING CO. ARIZONA.

Office: 402–130 Dearborn St., Chicago, Ills. Letter returned unclaimed from former mine office, Groom Creek, Yavapai Co., Ariz. R. A. Sweet, president and treasurer; J. B. Pogue, secretary; A. J. Pickrell, general manager; J. Chidister, superintendent. Organized 1901, under laws of Arizona, with capitalization $4,000,000, shares $1 par. Lands, 35 claims, area 700 acres, including the Rockefeller, Chicago, President and Little Kid claims, in the Hassayampa and Big Bug districts, showing numerous fissure veins, carrying auriferous and argentiferous oxide, carbonate and sulphide ores of copper, with claimed average values of 7% copper, 46 oz. silver and $38 gold per ton, and undetermined lead values. Has 34 pits and shafts, claimed to be of 10′ to 815′ depth, and 21 tunnels, claimed to be of 20′ to 800′ length, claimed to give about 2 miles of underground openings. Company claims to have 150,000 tons of ore blocked out for stoping. Has a steam power equipment, with hoists, shops, etc., also a 10-stamp mill, 50-ton cyanide plant, and 50-ton concentrator. Company claims to have been developing since 1904, and claimed, falsely, to be running the mill night and day—but kept on peddling stock. If the outfit be anything but a rotten

stock-jobbing scheme, the company should sue General Appearances for presenting the management in such an unfavorable light.

GOLD & COPPER DEEP TUNNEL MINING & MILLING CO. NEW MEXICO.

Office: care of A. Dom, secretary and treasurer, 780 E. Madison Ave., Cleveland, Ohio. Mine office: Elizabethtown, Colfax Co., N. M. Employs 6 men. A. T. McIntyre, president; John Pearson, vice-president; W. P. McIntyre, mine superintendent. Organized October, 1900, under laws of New Mexico, with capitalization $2,000,000, shares $1 par; issued, $1,940,000. Annual meeting, second Tuesday in July.

Lands, 10 claims, area circa 100 acres, also a 2.5-acre millsite, on the western slope of Baldy Mountain, in the Moreno district, showing limestone, quartzite, slate and porphyry country rocks, with fissure and contact veins in and between quartzite and slate. Has 2 shallow shafts and a 1,900′ crosscut tunnel, opening 2 large ore bodies of low-grade auriferous copper ore. Has gasoline power and electric drills, with a 20-ton stamp-mill of lumber and logs, size 40x80′, equipped with a 5′ Huntington mill and gravity stamps. Nearest railroad, 3 miles. Company plans continuing development steadily. Management and property are well regarded.

GOLD & COPPER FIELDS SYNDICATE, LTD. AUSTRALIA.

Voluntarily liquidated, March, 1902.

GOLD-COPPER MINING CO. ARIZONA.

Office: Prescott, Arizona. Col. E. Routman, general manager. Lands, in the Hassayampa district, include the Peacock, Mountain View and Iron Duke claims, opened by a 180′ tunnel, cutting a vein carrying auriferous and argentiferous copper ore, that has given assay values of $30 per ton.

GOLD-COPPER MINING CO. CALIFORNIA.

Office: care of J. McCosh Smith, Rocklin, Cal. Mine office: Lincoln, Placer Co., Cal. Lands, 160 acres, slightly developed by shaft.

GOLD & COPPER MINING CO. NEW MEXICO.

Letter returned unclaimed from former mine office, Rociada, N. M.

GOLD-COPPER MINING & DEVELOPMENT CO. SOUTH DAKOTA.

Letter returned unclaimed from former office, Deadwood, S. D.

GOLDEN COVE MINING CO. NEW MEXICO

Mine office: Hachita, Grant Co., N. M. W. H. Hare, president; W. T. Stewart, vice-president; Fred. E. Emery, secretary and treasurer. Has several shafts of 10′ to 85′ depth, showing a vein said to give average assays of 18% copper and 20% lead, with gold and silver values.

GOLDEN EDGE MINING CO. WYOMING.

Letter returned unclaimed from former mine office, Rambler, Carbon Co., Wyo. Lands were sundry claims, south of Rambler, showing copper ore.

GOLDEN GATE GROUP. COLORADO.

An idle prospect, near the foot of Badger Mountain, Tarryall district, Park county, Colorado, said to show a vein of 10′ to 30′ width, giving assays of 12% to 62% copper, and $10 and upwards gold per ton.

GOLDEN KEY MINE. **WASHINGTON.**

Letter returned unclaimed from former mine office, North Bend, Wash.

GOLDEN MINT MINES, LTD. **NORWAY.**

Voluntarily liquidated, October, 1903.

GOLDEN RULE COPPER MINING & SMELTING CO. **ARIZONA.**

A fraudulent mining company, formerly at 220 Broadway, New York, and having 17 claims, near Oracle, Pinal county, and Vail, Pima county, Arizona. Was promoted by one Wm. E. Lake, "a prominent church and sunday school worker" of Yonkers, N. Y., who purchased sundry cheap holes in the ground in Arizona, at a cost of $500, and thereupon organized a million-dollar company, keeping for himself all but the 7 shares required for dummy directors. He then pledged the company to pay him $15,000, and generously donated 200,000 shares to the treasury. Purchasers thought they were obtaining treasury stock, and Christian friends invested $125,000, of which only $15,000 ever was accounted for. Assets of the company, at the time of the show-down, were a donkey hoist in Arizona, and a roll top desk in New York, the company having lost the hole in the ground on which it was incorporated originally. Moral: beware of stock-peddlers who mix piety with business.

GOLDEN STAR MINING CO. **IDAHO.**

Letter returned unclaimed from former mine office, Doniphan, Idaho.

GOLDEN STATE MINES, LTD. **ARIZONA.**

Offices: 20, Lawrence Lane, London, E. C., Eng. C. F. Branton, director; G. Thompson, secretary. Organized June 25, 1897, as reconstruction of Geldfontein Estates & Gold Mining Co., Ltd., with capitalization £100,000, shares 5s. par; issued, £61,254. Lands, 120 acres, on Copper Creek, in the Dragoon Mountains, Cochise county, Arizona, supposed to have a small smelter. Idle for some years.

GOLD HILL COPPER CO. **NORTH CAROLINA.**

Office: 80 Broadway, New York. Mine office: Gold Hill, Rowan Co., N. C. W. G. Newman, president; Wm. M. Richardson, secretary and treasurer. Capitalization $5,000,000. Lands, 1,050 acres, in Rowan and Stanley counties, North Carolina, well watered and timbered, including the Gold Hill mine, operated spasmodically since circa 1850, and which has secured a very considerable gold production. Mine has a 750′ main shaft, and ore is said to average 2.75% to 3% copper, with good gold values. Property is served by the Southern Railroad, and the Yadkin river has 7,500-h. p. available, 17 miles from Gold Hill, and development of this power is now under way. Fuel is bituminous coal, costing $2.25 per ton, delivered, and labor is $1 per day. Present company worked on a considerable scale, 1901–1903, employing 250 men, but got into financial difficulties, ending, 1903, in the appointment of C. M. Miller as receiver. At last accounts, mine was being kept unwatered, and management hoped to arrange for resumption of work.

GOLD HILL QUARTZ MINING CO. **OREGON.**

Office: 111 Fifth Ave., New York. Mine office: Gold Hill, Jackson

Co., Ore. C. R. Ray, superintendent. Property includes the Braden, Conger and Elk Creek mines, ores of which carry gold, silver, lead and copper. Has steam power and a 10-stamp mill, employing circa 30 men, at last accounts.

GOLD KING CONSOLIDATED MINES CO. **COLORADO.**

Office: Waterville, Me. Mine office: Silverton, San Juan Co., Colo. W. Z. Kinney, superintendent. Ores carry gold, silver and copper. Has steam, electric and gasoline power and an 80-stamp mill, producing mainly gold, with a little copper secured as a by-product.

GOLD MOUNTAIN MINING CO. **WASHINGTON.**

Mine office: Berlin, King Co., Wash. F. Karl, superintendent, at last accounts. Has antimonial gold-copper ores, opened by tunnel, with water and electric power.

GOLDSMITH COPPER CO., LTD. **BRITISH COLUMBIA.**

Presumably dead. Had lands on Howe Sound, British Columbia.

GOLD STAR MINING CO. **WASHINGTON.**

Office: 2107 E. Madison St., Seattle, Wash. Mine office: Index, Snohomish Co., Wash. Aden Fraser, president; John Edmond Praul, secretary, treasurer and general manager. Organized 1903, under laws of Washington, with capitalization $1,000,000, shares, $1 par; issued, $500,000. Lands, 6 claims, area 120 acres, well timbered, in the Index district, showing a country rock of syenite, carrying a 6′ vein giving assays of 7% copper and $1.20 gold per ton, from bornite, and $25 gold per ton from an oxidized quartz capping. Is 4 miles from the Great Northern Railway. Idle, but plans resumption of work during 1906.

GOLD TUNNEL & RAILWAY CO. **COLORADO.**

Mine office: Silverton, San Juan Co., Colo. Wm. Cole, superintendent. Early in 1906 employed about 25 men, and was shipping 100 to 150 tons monthly of ore giving smelter returns up to $100 per ton, in copper and silver.

GOLETA CONSOLIDATED MINES. **CALIFORNIA.**

Mine office: Jordan, Mono Co., Cal. Hugh W. Nelson, superintendent, at last accounts. Property is a gold mine, equipped with a 40-stamp mill and cyanide plant, but has a 6′ vein of chrysocolla, slightly developed.

GOLINSKY MINES. **CALIFORNIA.**

Sold, 1904, to Mammoth Copper Mining Co.

SUCESION E. GONZALES. **MEXICO.**

Office, mine and works: Guanajuato, Gjto., Mex. Has a small smelter, known as the Salgado. Production, 1903, was 5,793 kgs. blister copper.

SUCESION P. GONZALEZ. **CHILE.**

Office and mine: Labrar, Freirina, Atacama, Chile. Has a matting furnace and produces circa 1,250,000 lbs. fine copper yearly.

GOOD HOPE MINING & REDUCTION CO. **COLORADO.**

Office: Del Norte, Colo. Mine office: Vulcan, Saguache Co., Colo. Louis Weiss, superintendent. Ores carry gold, silver and copper. Has steam power. Idle.

GOODLANDER MINING & MILLING CO. **MEXICO.**

Office: 603 New Ridge Bldg., Kansas City, Mo. Letter returned unclaimed from former mine office, Moctezuma, Sonora, Mex. Alfred Blaker, president; John W. Amerman, secretary; Geo. F. Woodward, general manager. Capitalization $1,000,000. Ores carry gold, silver and copper. Mine is opened by shaft. Has steam power and a 10-stamp mill. Idle and apparently moribund.

GOODRICH PROPRIETARY. **AUSTRALIA.**

Mine office: Yeoval, New South Wales, Australia. F. Pearce, manager. An old property, once a considerable producer of gold and copper, reopened, 1902, by a new 450′ shaft, sunk to get beneath the former workings, which have been reached by a crosscut. Ore assays 18% copper and 4 oz. gold per ton, and occurs in a pipe-vein about 300′ in diameter. Mine has given much trouble in the past, from caving, and requires very careful handling.

GOODSPRINGS SMELTING & DEVELOPMENT CO. **NEVADA.**

Office: Los Angeles, Cal. Works office: Goodsprings, Lincoln Co., Nev. A. H. Gates, president; Geo. W. Hinckley, vice-president; Warren W. Porter, secretary and treasurer; C. H. Raymond, assistant manager; preceding officers, W. E. Jeannot, R. S. Hardy and W. H. Wilson, directors. Contracts have been let for a 225-ton furnace, with other equipment for a 500-ton smelter. Company is laying out a townsite at Goodsprings, and plans installing water-works and electric light, and opening a general store, also building an electric belt-line reaching various adjacent mines, and a 7-mile railway spur from Goodsprings to Goodsprings Siding, on the Salt Lake railway. Contracts have been made with a number of mines in the vicinity, and company plans smelting auriferous and argentiferous copper and lead ores, and may install a zinc smelter later. Fuel will be coke from Utah and petroleum from Los Angeles, both available on the line of the Salt Lake railway.

GOOD VENTURE COPPER MINING CO. **NEW HAMPSHIRE.**

Letter returned unclaimed from former mine office, Woodville, N. H.

GOODVENTURE MINING & MILLING CO. **WYOMING.**

Presumably dead. Letters returned unclaimed from former office, Boston, Mass., and former mine office, Hecla, Laramie Co., Wyo.

GOTHIC MILLING, MINING & POWER CO. **COLORADO.**

Letter returned unclaimed from former office, Masonic Bldg., Peoria, Ills. Mine office: Crested Butte, Gunnison Co., Colo. James Donn, president; M. W. Jones, secretary; F. L. Clemens, general manager. Mine, opened by shaft and tunnel, shows ores carrying silver, lead and copper. Is claimed to have a 50-ton concentrator, and two 50-ton smelters.

BERGWERK GOTTLICHE HÜLFE STOLLN. **GERMANY.**

Mine office: Tannenbachstal bei Brunndöbra-Georgenthal, Saxony, Germany. Presumably idle.

GOULAIS BAY MINING CO. **ONTARIO.**

Lands, 1,300 acres, on Goulais Bay, Lake Superior, 26 miles north of

Sault Ste Marie, Algoma, Ontario, on which a little exploratory work was done, circa 1902. Capitalization, $3,000,000. Idle and apparently moribund.

GOULD COPPER MINING CO. **ARIZONA.**

Mine office: Tucson, Pima Co., Ariz. S. H. Gould, president; W. H. Dailey, secretary. Lands, 19 claims, in the Tucson Mountains, 15 miles west of Tucson, covering nearly one mile of the east and west strike of a mineral formation circa 2,000′ wide and 5 miles long. Country rocks are limestone and quartzite, and ore is chalcopyrite, with quartz gangue, averaging 3% to 4% copper, 3 oz. silver and $1.50 gold per ton, with sufficient iron to be self-fluxing. Development is by shafts of 50′, 125′ and 375′, and 2 tunnels. A two-compartment main shaft is said to show a 35′ vein on the 100′ level′, and a 45′ vein on the 200′ level. Has a gasoline engine and air-compressor. Management seems good and property is considered promising.

GOULD MINING CO. **WYOMING.**

Mine office: Centennial, Albany Co., Wyo. Lands, sundry claims on the summit of Centennial Mountain, said to show ore assaying 30% copper and $50 gold per ton. Presumably idle.

GRAFTER MINE. **YUKON.**

Office: Whitehorse, Yukon, Canada. Shipped 450 tons of high-grade ore to the Crofton smelter, circa 1903-1904. Property is considered promising, but is handicapped by the exorbitant transportation charges on its ore, and cannot be developed to the point of large and profitable production without the establishment of a local smelter, or securing living freight rates.

GRAHAM COUNTY MINING CO. **ARIZONA.**

Office: 1509-20 Broad St., New York. Mine office: Fort Grant, Graham Co., Ariz. John W. Manning, president; Schuyler S. Moore, secretary and treasurer; Prof. Geo. A. Treadwell, consulting engineer. Capitalization $250,000, shares $10 par. Lands, sundry gold-copper claims in the Clark district, on which the company claims to have expended upwards of $100,000 in development work. Idle for several years, except for annual assessment work, but efforts are being made to effect a reorganization.

GRANBY CONSOLIDATED MINING, SMELTING & POWER CO. **BRITISH COLUMBIA.**

Office: 52 Broadway, New York. Mine office: Phœnix, B. C. Works office: Grand Forks, B. C. Employs 850 men, of whom approximately 475 are at the mines and 375 at the smelter. Jacob Langeloth, president; Jay P. Graves, vice-president and general manager; preceding officers, Wm. H. Nichols, Berthold Hochschild, George Martin Luther, George Crawford Clark, Arthur C. James, Geo. F. Baker, Jr., Payne Whitney, Henry Lee Higginson, A. L. White, Sanford H. Steele, Geo. Crawford Clark, Jr., and Edwin Thorne, directors; Northrup Fowler, secretary; G. W. Wooster, treasurer; A. B. W. Hodges, general superintendent; O. B. Smith, Jr., mine superintendent; W. A. Williams, smelter superintendent; J. C. McDonald, master mechanic; C. E. Lane, electrician; Miles Barrett, smelter foreman; Philip Herr, converter foreman.

Organized March 1901, under special charter from the Province of British Columbia, with capitalization $15,000,000, par changed, 1906, to $100 per share, non-assessable and fully issued. Stock is listed on the Boston Stock Exchange. Has circa 2,000 shareholders of record. First dividend, of 1%, amounting to $133,630.30 was paid Dec. 16, 1903. No dividends were paid 1904; paid one dividend of 3%, amounting to $405,000, in 1905, and a third dividend of 3%, May 16, 1906. Fiscal year ends June 30. Annual meeting, first Tuesday in October. Boston Safe Deposit & Trust Co., registrar; American Loan & Trust Co., Boston, transfer agent.

Lands, 27 claims, area 790 acres, crown-granted, also 500 acres of mill and smelter sites and 800 acres miscellaneous lands, in the Osoyoos mining district, Boundary division, Yale district, British Columbia, very near the United States line. Mining properties included the Old Ironsides, Knob Hill, Victoria, Grey Eagle, Banner, Tip Top and Triangle claims, to which were added, by purchase, during 1904-1905, 13 other mines and claims, as follows: Gold Drop Group, area 4 claims, bought for $225,000; No. 13 claim, bought for $12,000; Monarch & Tamarack group, area 4 claims, bought for $80,000; Monte group, area 4 claims, bought for $15,000, giving an investment of $432,000 in mining lands for the two years. With these recent purchases, the mineral lands of the company form a compact tract of 8,000′ east and west by 9,000′ north and south, giving nearly two miles of the strike of the mineral zone. Miscellaneous landed holdings include a 61-acre limestone quarry, for flux, and several hundred town lots, at Grand Forks and Phœnix, also 500 acres at Carson, British Columbia.

Country rock is andesite, carrying two wide fissure veins in quartz-diorite, these having an approximately north and south strike, with a surface dip of 50° to the eastward, and a somewhat sharper dip at depth. Ore bodies are an altered tuff, estimated by company at 80′ average width, which is an ultra-conservative figure. Ore is exclusively chalcopyrite, averaging about 1.7% copper only, with an average of 0.4 oz. silver and $1.50 gold per ton, the ore carrying only 5% to 6% sulphur. The main ore body ranges up to 400′ width, at points, and has been opened to a depth of 500′, while diamond drill borings have shown it to continue, with unaltered values, to a depth of at least 800′.

The mine is opened by shafts of 200′ and 400′, and by tunnels of 1,500′, 2,600′, 2,400′ and 2,500′, with 6 miles of crosscuts and drifts, giving a total of 8 miles of underground workings. Notwithstanding this very respectable total of strictly underground openings, the principal developments are open-cast, the present policy of the management being to extract the bulk of the ore from glory-holes, which are immense open quarries. These open pits are worked in 100′ benches, from which 50′ slices are taken by 3 steam shovels, the largest having a daily capacity of about 1,500 tons, ore being shattered by blasting before removal by shovels, and are milled through winzes to underground tunnels, for loading and removal. The largest pit is 400x1,000′ in area and the plans of the company practically call for the mining off of an entire mountain. Ore reserves were estl-

mated, 1904, by the company, at 20,000,000 tons, but actually were much larger, and have been greatly added to since. It has been proposed to drive a four-mile double-track railway tunnel into the mountain, from Boundary Creek, to tap the ore bodies, now opened on surface, at a depth of about 4,000′. Should this tunnel show a continuation of the immense vein at that depth, as it possibly would, the Granby's ore body then would be proven much larger than the combined ore reserves of the Rio Tinto.

No. 2 shaft has a 12x16″ double-cylinder hoist, and a 3-compartment shaft is being sunk on the Victoria claim, centrally located on the Granby's mineral tract. This shaft, owing to its large size, and comparatively shallow depth, is expected to have a capacity of 1,500 tons per 8-hour shift.

Three tunnels are double-tracked and equipped with electric-traction, having 75-h.p. motors drawing ten-ton ore-cars. These tunnels are equipped, at their portals, with ore-crushers and 2,000-ton ore bins. There are three crushers, of 150 tons hourly capacity each. At the portal of No. 3, the upper tunnel, is a 22x55′ crusher-house with a Farrell-Bacon style Bore crusher, having steel jaws 30x42″ in size, of 150 tons hourly capacity, driven by a 100-h. p. electric motor. The crusher is capable of breaking masses of nearly one cubic yard in size, to chunks not larger than 7″ to 8″. A duplicate crusher, made by the Jenckes works, is located at the mouth of No. 4 tunnel. The crusher weighs 113,000 lbs., and has a frame of semi-steel, with tensile strength of 32,000 lbs. to the square inch. Ore from the bins is shipped to the smelter over the Great Northern railway, and a train of 35 thirty-ton cars can be loaded in 25 minutes. The mine is served by both the Great Northern and Canadian Pacific railways.

Equipment at the mine includes all necessary machinery, but the mining plant, from the nature of operations, is much less powerful and costly than is found at many smaller mines operated to greater depths, and exclusively underground. There are 250-h. p. hoists, good for 1,000′ depth, at each shaft. The compressor-house, 60x121′ in size, houses two air-compressors, and 65 rock-drills are in use in the mine. The compressors are electrically driven by rope transmission from two 700-h. p. Westinghouse type C induction motors. The principal compressor is a Rand tandem-compound, with 16x30″ high-pressure cylinders and 28x36″ low-pressure cylinders, capable of compressing 6,000 cubic feet of free air per minute to a pressure of 70 lbs. per square inch, and is rated at 60-drill capacity. The mine buildings include a 40x80′ machine shop, 40x50′ smithy and 40x40′ carpenter shop, all of frame construction. The company owns 20 dwellings and 2 hotels at Phœnix, the Granby hotel being a $25,000 three-story structure with electric light and steam-heat.

The mine has 2,000 h. p., and the smelter uses 1,500 h. p., this being furnished from an electric plant at Kettle Falls, on the Columbia river, Washington. These falls are among the largest natural water powers of North America, and, with added equipment can generate as much power as the mine and smelter are likely ever to require.

The smelter, at Grand Forks, 24 miles from the mine, is connected therewith by the Canadian Pacific railway, there being a drop of 2,000′ on the loaded haul, in this distance. The reduction plant is much the largest and best in Canada, and among the smelters of the world ranks only after those of the Anaconda and Copper Queen. The capacity of the plant is 3,000 tons per diem, and the smelter is operated three 8-hour shifts daily. The plant is being enlarged constantly, in a vain attempt to keep pace with the possibilities of the great mine behind it, and, large as it already is, has by no means reached its ultimate limit of size, which, in all likelihood, will not be less than 10,000 tons daily, and may be more, in time. The smelter has 6,000-ton steel ore-bins and six 300-ton rectangular blast-furnaces, each 44x160″ at the tuyeres, and two 400-ton furnaces, each 48x208″ at the tuyeres, added 1905. The six old furnaces may be rebuilt to much larger size. The two larger furnaces have 24 tuyeres on each side. An ingenious system of charging, devised by Mr. A. B. W. Hodges, effects great economies in this branch of work, saving labor and giving more regular feed. The charges are supplied to the furnaces in two-ton cars, one 20-h. p. electric motor handling two cars, only one man being required to attend to the charging of two furnaces. The ore is practically self-fluxing, and with a little limestone and necessary fuel, is charged without concentration or assortment. The first-fusion product is a 40% matte, which is carried molten, in ladles, by a 40-ton electric traveling crane, to the converter building, 68x160′ in size, which is 100′ from the furnace building. The converter department has 3 stands, with shells 70x110,″ of the horizontal barrel type, shells being tilted in stands by Allis-Chalmers hydraulic accumulators. There are three mould-carriers under each stand, and product of the converters is a 99% blister copper carrying 40 oz. silver and 8 oz. gold per ton, which is shipped to the Laurel Hill works of the Nichols Chemical Co., for electrolytic refining, and parting of gold and silver values. In the converter building is the lining department, equipped with a crusher and two silica-mills. Slags were granulated, but are now dumped hot, four 8x14″ locomotives traversing a 36″ railway line with slags.

Electric power is used exclusively at the smelter, machinery equipment including nine blowers, being one for each furnace, with an auxiliary in reserve. A new Connersville blower, of 30,000 cubic ft. capacity per minute, is to be installed, with a direct-connected 300-h. p. motor. Converter blast is supplied by a new Allis-Chalmers double-cylinder air-compressor, with capacity to compress 6,000 cubic ft. of free air per minute to a pressure of 10 lbs. per square inch, actuated by a direct-connected 300-h. p. motor.

The wooden framework of the smelter buildings is being replaced by steel, and all structures are to be thus replaced, eventually. A new steel-frame warehouse and a roundhouse were built at the smelter, during 1905.

Much trouble was experienced, in the early years of production, in securing adequate coke supplies, and to obviate future difficulties from this source, the International Coal & Coke Co. was organized, 1903, with a capitalization of $3,000,000, by practically the same shareholders as those of

the Granby, although the corporations are distinct. The International company has extensive high-grade deposits of coking coal at Blairmore, Alberta, Northwest Territory, and furnishes the Granby an assured supply of coke for the furnaces.

Production, for the fiscal year 1905, was 14,237,622 lbs. fine copper, and, for the calendar year 1905, was 17,843,390 lbs. copper, 217,472 oz. silver and 50,694 oz. gold. At the close of 1905 the mine was making about 2,000,000 lbs. fine copper monthly, and netting approximately 10 cents per lb., or $200,000 per month, therefrom. The enlargement of the six old 300-ton furnaces will give the smelter a daily capacity of about 3,600 tons, before the close of 1906, putting the Granby plant second only to the Anaconda in size, and adding 20% to the present productive capacity. By the close of 1906, copper should be made for about 8 cents per pound—a remarkable achievement, considering the exceeding low grade of the ore. Both mine and mill have been brought to a high state of efficiency, and the cost-sheet is one of which any directorate well might be proud. There will be no cessation of effort however, and the skill and energy of the management assure further reductions in cost per ton mined and smelted, as well as an increase in tonnage handled, and production secured. The Granby is one of the few copper properties of the world of which a careful investigation leads to the verdict that there is nearly everything to commend, and scarcely anything to criticise.

GRAND CANYON COPPER CO. **ARIZONA.**

Mine office: Grand View, Coconino Co., Ariz. Mine is located near the bottom of the Grand Cañon, 3,000′ below the rim. Idle.

GRAND CENTRAL MINING CO. **UTAH.**

Mine office: Tintic, Juab Co., Utah. Patrick Donnelly, superintendent. Is an auriferous silver-lead mine, carrying appreciable values in copper, extensively developed, and a considerable producer. Employed about 90 men, at last accounts.

GRAND DEPOSIT COPPER CO. **NEVADA.**

Office: Cherry Creek, White Pine Co., Nev. John Stanton, president; J. S. Page secretary; Pierre de P. Ricketts, treasurer. Organized 1903. Lands are the Grand Deposit group, said to show considerable ore bodies, giving assays of 7% to 12% copper.

MINAS GRANDE y COBRE GRANDE. **MEXICO.**

Letters returned unclaimed from former mine office, Fronteras, Sonora, Mexico.

GRAND GULCH COPPER MINING CO. **ARIZONA.**

Office: care of Messrs. Schirmer, Chapin & Emmons, 79 Milk St., Boston, Mass. Mine office: St. George, Washington Co., Utah. Samuel Newhouse, general manager. Property is in the extreme northern part of Arizona, and more accessible from Utah than from southern or central Arizona. Main shaft is 370′ deep. Shipment of 1,000 tons of ore to Salt Lake smelters gave average returns of 48% copper, netting $99,970. Ore was carefully selected, and hauled 140 miles by wagon. Equipment includes a small and antiquated smelter.

GRAND GULCH MINING CO. **ARIZONA.**

Succeeded by Grand Gulch Copper Mining Co.

GRAND JUNCTION SMELTING CO. **COLORADO.**

Office: 79 Milk St., Boston, Mass. Works office: Grand Junction, Mesa Co., Colo. I. N. Patterson, president; J. V. Howard, secretary; Geo. E. Marvin, general manager. Has a considerable indebtedness, held by shareholders. Has a partly built custom smelter, planned for steam and electric power, which company planned to blow in early in 1905, but failed to so do. Affairs apparently badly involved.

GRAND MARAIS COPPER MINING CO. **MINNESOTA.**

Had lands in Cook county, Minnesota. Idle, and company apparently moribund.

GRAND MOUNT LYELL COPPER CO., LTD. **TASMANIA.**

Mine office: Mt. Lyell, Montagu Co., Tasmania. Lands, sundry claims, in Sections 682, 789 and 1,674, slightly prospected.

GRAND PRIZE COPPER MINING CO. **ARIZONA.**

Dead. Lost lands, 1902, for debt.

GRAND RAPIDS COPPER CO. **WYOMING.**

Dead. Lands sold to Saginaw Valley Copper Mining Co.

GRAND REEF COPPER MINING CO. **ARIZONA.**

Office: care of Clarence H. Mackay, 253 Broadway, New York. Mine office: Aravaipa, Graham Co., Ariz. James Quinn, superintendent. Lands, sundry claims, presumably patented, on which large sums were expended, in development and equipment, latter including a 3-stamp mill and 90-ton smelter. Idle for some years.

GRAND REPUBLIC COPPER MINING CO. **COLORADO.**

Office: 52-240 La Salle St., Chicago, Ills. Letter returned unclaimed from former mine office, Pearl, Larimer Co., Colo. W. A. McGuire, president; E. V. Boisot, secretary and treasurer. Organized 1902, under laws of Wyoming, with capitalization $1,500,000, shares $1 par. Lands, 7 claims, area 70 acres, in the Big Horn district, 7 miles south of Pearl, showing a 3′ paystreak, carrying considerable native copper, in a schistose vein, cut at depth of 130′ by a 200′ shaft. Also has a sulphide ore body.

GRAND TRAVERSE & ARIZONA MINING CO. **ARIZONA.**

Office: 129 East Front St., Traverse City, Mich. Mine office: Cave Creek, Maricopa Co., Ariz. Employs 3 to 10 men. Thos. Smurthwaite, president and general manager; Walter E. Greilick, vice-president; Chas. F. Smurthwaite, secretary and treasurer; preceding officers, Warren A. Cartier and Philip Shermer, directors; H. Bolin, superintendent. Organized May 6, 1903, under laws of Arizona, with capitalization $1,000,000, shares $1 par; issued, $1,150,000. Lands, 22 claims, area 440 acres, in the Cave Creek district, showing 9 veins, of which 3, under development, have average widths of 8′, 14′ and 18′, giving assays of 5% to 35% copper, 8 oz. to 12 oz. silver and $8 to $120 gold per ton, from oxide, carbonate and sulphide ores. Is opened by 5 pits and shafts, deepest 70′ and 170′, and by tunnels of 60′ and 105′. Nearest railroad, 38 miles.

GRANDVIEW MINING & MILLING CO. **UTAH.**

Said to have lands in Utah, near the Colorado line, from which ore giving good assay values in gold, silver and copper, has been secured.

LA GRAN FUNDICIÓN CENTRAL MEXICANA. **MEXICO.**

Is the Aguascalientes branch of the American Smelting & Refining Co.

GRANITE CREEK SMELTING & REDUCTION CO. **NEVADA.**

Presumably dead. Disappeared from Golconda, Humboldt Co., Nev.

GRANITE WELLS MINING CO. **CALIFORNIA.**

Office: 716 Lankershim Bldg., Los Angeles, Cal. Lands are sundry claims in San Bernardino county, California, showing a stained quartzite capping 60′ wide and 200′ long, standing 30′ above surface, underlaid by a pipe vein of 2″ to 2′ width, between quartzite, gneiss and syenite, carrying very rich ores, mainly cuprite, assaying 17% to 62% copper, in the upper levels, turning to sulphide ores at a depth of circa 250′. Company claims to have 200 tons of very rich ore on the dump.

LA GRAN PROVEEDORA DE COBRE, S. A. **MEXICO.**

Is the Mexican incorporation of the Arizona-Mexican Copper Co.

GRANT COPPER MINING CO. **COLORADO.**

Office: Encampment, Wyo. Letters returned unclaimed from former mine office, Pearl, Larimer Co., Colo. Leo Davis, president; C. W. Taylor, vice-president; H. D. Ashley, secretary; Theo. Davis, treasurer. Organized 1901, under laws of Wyoming, with capitalization $1,000,000. Lands, 3 claims, one-half mile from Pearl, alleged to show a 12′ vein giving average assays of 10% copper. Idle several years.

GRANVILLE COPPER CO.

Office: 519 Gaither Estate Bldg., Baltimore, Md.

GRAPHIC MINE. **NEW MEXICO.**

Office: care of Sherwin-Williams Paint Co., Cleveland, Ohio. Mine office: Magdalena, Socorro Co., N. M. Lands, in the Kelley district, show a 65′ vein, with a 12′ paystreak said to average 13% copper, opened by tunnel. Country rocks are limestone of Carboniferous age, shales and quartzite. Ores are argentiferous galena, smithsonite, cuprite and native copper. Mine produced about $30,000 in values, before taken over by present owners, and was shipping about 100 tons daily, at end of 1905, to Joplin, Missouri, the zinc ore being used for making zinc oxide, for pigments. Management is said to plan increasing production to 200 tons daily.

GRASLITZER KUPFERBERGBAU. **AUSTRIA.**

Mine office: Eilenberg, Bohemia, Austria. Mines are very ancient, and were one of the principal sources of European copper supply, during the Middle Ages. Vein is 12′ to 15′ wide, in clay-slate. Mines were reopened on a large scale, 1901, and a new smelter built, but the experiment does not seem to have proven successful.

GRATIOT MINING CO. **MICHIGAN.**

Office: 12 Ashburton Pl., Boston, Mass. Mine office: Calumet, Houghton Co., Mich. Quincy A. Shaw, Jr., president; Rudolph Agassiz, vice-president; preceding officers, Alexander Agassiz, Francis L. Higginson and

Francis W. Hunnewell, directors; Geo. A. Flagg, secretary and treasurer; James MacNaughton, general manager. Organized January 29, 1906, under laws of Maine, with capitalization $300,000, shares $3 par, full-paid and nonassessable. Is a subsidiary corporation of the Calumet & Hecla Mining Co., formed for the purpose of taking over 600 acres of land lying north of the Mohawk mine, supposedly carrying the northern extension of the Kearsarge amygdaloidal bed. Is considered exceptionally promising.

O. B. GRAY COPPER CO. **NEW JERSEY.**

Mine office: Pennington, Mercer Co., N. J. Organized May, 1901, with capitalization $250,000. Vein is claimed to be 30′ wide and one-half mile long. Idle since shortly after birth.

GRAY EAGLE & HARD TIMES MINES. **COLORADO.**

Letter returned unclaimed from former mine office, Silver Cliff, Colo.

GREAT BELCHER OF ARIZONA CO. **ARIZONA.**

Office: 519-10 Wall St., New York. Mine office: Providence, Yavapai Co., Ariz. Isaac W. Mason, president and treasurer; Henry B. Clifford, vice-president; P. H. Noel, secretary, T. S. Henderson & Co., fiscal agents. Organized under laws of Arizona, as successor of the Great Belcher-Bullwhacker Gold Co., which, in turn, was a merger of the Great Belcher Gold & Copper Co., Bullwhacker Mining Co., Empress Mining Co., Sunlight Mining Co. and Queen of Arizona Copper Co. Extent of lands of present company unknown, but includes the Great Belcher mine, one patented claim, which is said to have produced $700,000 in ore values, in the past, and which has a 700′ main shaft, with circa 4,000′ of underground openings. Company claims a 17′ vein of ore, averaging $12 per ton, mainly in gold, on the 700′ level, and plans sinking to 1,000′.

GREAT BELCHER-BULLWHACKER GOLD CO. **ARIZONA.**

Reorganized, circa 1905, as Great Belcher of Arizona Co.

GREAT BELCHER GOLD & COPPER CO. **ARIZONA.**

Reorganized as Great Belcher-Bullwhacker Gold Co.

GREAT CENTRAL FREEHOLD MINES, LTD. **AUSTRALIA.**

Voluntarily liquidated, 1903.

GREAT CENTRAL MINES. **AUSTRALIA.**

Mine office: Mt. Hope, Blaxland Co., N. S. W., Australia. J. Martin, superintendent. Lands, 939 acres, at South Mt. Hope, showing large bodies of low-grade ores, which are oxides and carbonates to about 250′ depth, succeeded by sulphides. Oxidized ores have a decomposed porphyry gangue, sulphide ores occuring in brecciated porphyry. Has steam power and a small smelter, and is hampered by a somewhat uncertain water supply.

GREAT COBAR COPPER MINING SYNDICATE. **AUSTRALIA.**

Offices: Equitable Bldgs., Sydney, Australia. Mine office: Cobar, Robinson Co., N. S. W., Australia. Works office: Lithgow, N. S. W., Australia. Employs circa 300 men. Dr. Richard Read, mining director; Wm. Longworth, general manager; G. H. Blakemore, mine manager. This is the most important copper producer of New South Wales, having been first opened in 1869, and closed 1892, after failure to reduce sulphides in a rever-

Lands, 80 acres mining lands and 970 acres miscellane
hold, including the townsite of Cobar, also the Nymagee
Nymagee, the Great Peak gold mine at Cobar, sundry coal
gow and Rix Creek, yielding, good coking coal, and the
Smelting & Refining Works, at Lithgow. The Great Cob
three veins of nearly vertical dip, known as the East, Mi
lodes, principal openings being on the latter. Country r
slate, and the ore, which is auriferous and bismuthifer
lenses, 50′ to 70′ in width by 200′ to 300′ in length, ar
depth. The oxidized zone extends to an average depth of
which the ore is mainly chalcopyrite, with some cuprifer
the average copper tenor of the entire mine being about
0.5 oz. silver per ton. Ore is won by overhand stoping, wit
beside the shafts, and timbering is by bulkheads, filled wi
being known locally as the "pigstye" system. The ore is
immense masses, then reduced to smaller size by block-hole
The West lode, opened by an 820′ shaft, is 70′ wide, at
90-fathom level, and the mine works about 20 stopes. The
850′ deep. The mine has about 11,000′ of workings, and i
owners to show about 2,000,000 tons of ore. Owing to
the country, operations were hampered, in dry seasons, by
hence a new dam has been built, impounding circa 100,000
water, and water cost now averages about 8s. per thousar

The Nymagee mine, opened 1880, at Nymagee, Prior
amba county, New South Wales, is about 50 miles from th
but lacks railway facilities. Country rocks are slate and san
ore body being 15′ to 20′ in width, and carrying 10% copp
about 250 long and of indefinite depth. Has 3 shafts, de
ores outside of the rich chute average about 2% copper
unworkable. The Nymagee has a pyritic smelter, with wa

at the Great Cobar mine has two 300-ton water-jacket blast-furnaces, continuous discharge of molten matte and slag into forehearths, and e into settlers, whence slag skims into one-ton Nesmith slag-pots, are drawn to the slag-dump by a small locomotive. Fuel at mine od and bituminous coal, costing, respectively, 7 shillings and 21 shil- per long ton, and for the smelter, coke, costing 42s. per ton, is used. roducer-gas plant is being added, for reverberatory smelting, and it is ned to increase the length of the reverberatories to about 50′ each.

Production, 1903, was circa 9,000,000 lbs. fine copper, made from roximately 140,000 tons of ore smelted, and presumably was about 0,000 lbs. in 1905. The management is cautious, yet liberal, and de- es great credit for having taken the mine, under many disadvantages, making it a success. The Great Cobar is second only to the Wallaroo Moonta, among Australian copper mines, and bids fair to become an easingly important producer.

EAT CONDURROW TIN & COPPER MINING CO., LTD. **ENGLAND.**

Dissolved, January 13, 1905.

EAT DIVIDE GOLD CO. **CALIFORNIA.**

Letter returned unclaimed from former mine office, Redding, Cal.

EAT DIVIDE MINES CO. **UTAH.**

Office: 14 West First South St., Salt Lake City, Utah. Mine office: coln, Tooele Co., Utah. Henry A. McCornick, president; Walter A. ke, vice-president and manager; Joseph H. Hurd, secretary; Rodney T. ger, treasurer; John B. Taylor, superintendent. Organized Aug. 15, 6, under laws of Utah, with capitalization $2,000,000, shares $5 par. nds, 40 claims, about half patented, area 560 acres, also a 10-acre millsite, ly timbered, showing fissures in and contacts between limestone and mbrian quartzite, of which the main vein is said to range 12′ to 50′ in dth, carrying ores said by company to assay 6% to 20% copper, 2 oz. 100 oz. silver, and from a trace to $150 gold per ton. Development by a 1,300′ tunnel. Mine was opened 1898, and has been under slow t continuous development since. Property is considered promising.

EAT DYLIFE LEAD & COPPER MINES, LTD.

An English corporation. Moribund.

EAT FREEHOLD MINE. **AUSTRALIA.**

Owned by Queensland Copper Co., Ltd.

EAT LAKES COPPER CO. **ONTARIO.**

Office: care of J. Wesley Allison, 51 East 44th St., New York. John cKinley, president; Horace Williston, secretary; Robert Sloane Bickford, asurer. Organized 1900, under laws of West Virginia, with capitalization ,000,000, shares $5 par. Lands, upwards of 4,000 acres, near Sudbury, goma, Ontario, carrying nickeliferous chalcopyrite, associated with iron rites. Has several shafts, deepest 150′, also an open-cut, with a consid- able amount of ore in sight. The Graf smelting process was tried, but oved a failure. Property is mortgaged, and affairs of corporation are what seems a hopeless muddle.

GREAT LAKES MINING & MILLING CO. **WYOMING.**

Letter returned unclaimed from former mine office, Encampment, Wyo.

GREAT LAKES MINING & SMELTING CO. **WYOMING.**

Office: Manitowoc, Wis. Letter returned unclaimed from former mine office, Encampment, Carbon Co., Wyo. Isaac Craite, president; R. W. Burke, vice-president; J. V. Miller, secretary; C. H. Seeger, treasurer; F. C. Miller, manager. Apparently moribund.

GREAT LAXEY, LTD. **ENGLAND.**

Offices: 55, Cross St., Manchester, Eng. Mine office: Laxey, Isle of Man, England. F. J. Robertshaw, chairman; J. Roberts, mine manager; J. Crossley, secretary. Organized March 3, 1903, as a reconstruction of the Great Laxey Mining Co., Ltd., with capitalization £30,000, shares 10s. par, in 45,000 cumulative 10% preferred and 15,000 ordinary shares. Lands, 1,103 acres, held under 31-year leases, expiring October, 1933, with royalty of one-eightieth to October, 1907, and one-fortieth thereafter. Lands carry lead, zinc and copper ores. Property is noted chiefly for the possession of the largest water-wheel in the world, but this has survived its usefulness, and has been displaced by a new power plant.

GREAT MAMMOTH COPPER MINING CO. **WASHINGTON.**

Dead. Promoters sold their own stock and pocketed the proceeds.

GREAT MOUNT LYELL COPPER CO., LTD. **TASMANIA.**

Reorganized, 1903, as Ballarat & Lyell Mines, Ltd.

GREAT NORTHERN COPPER CO. **NEWFOUNDLAND.**

Office: Corey & Braddock Aves., Braddock, Pa. Mine office: Twillingate, Newfoundland.

GREAT NORTHERN COPPER & GOLD MINING COMPANY OF QUEENSLAND. **AUSTRALIA.**

Reorganized, July 31, 1903, as Rosewood Creek Copper & Gold Mining Co., Ltd.

GREAT NORTHERN COPPER MINING CO. **NEVADA.**

Office: care of S. H. Browne, secretary and treasurer, Ogden, Utah. A. W. McGee, president; Daniel Covery, vice-president. Organized 1904, under laws of Utah, with capitalization $100,000, shares $1 par. Lands, sundry claims, known as the Great Northern group, in the Sierra Madre district of Box Elder county, Utah.

GREAT NORTHERN GOLD & COPPER MINING & MILLING CO. **OREGON.**

Mine office: Lostine, Wallowa Co., Ore. E. T. Sluer, superintendent. Lands, 13 claims, south of Lostine, said to show high-grade copper and silver ores.

GREAT NORTHERN MINING CO. **WASHINGTON.**

Letter returned unclaimed from former mine office, Baring, Wash.

GREAT PECK MINING CO. **ARIZONA.**

Office: 519-10 Wall St., New York. Hon. J. A. Beidler, president; Hon. James Tawney, secretary and treasurer; preceding officers, Hon. E. A. Minor, Hon. Herman G. Goebel, Hon. James H. Southard, Hon. Wm. E.

Brown, Hon. Lucius N. Littauer, Hon. J. W. Babcock, Wm. E. Bixby and Melville Woodbury, directors; Peter Giroux, general manager. Knickerbocker Trust Co., New York, registrar. Organized 1902, under laws of Arizona, with capitalization $2,500,000, shares $5 par. Lands, 2 claims, area 40 acres, patented, known as the Great Peck mine, which was a considerable silver producer in the past, until closed down by litigation. Mine carries silver, gold and copper values, and has about 5,000′ of workings. Officials are principally members of the United States Congress.

GREAT REPUBLIC COPPER & GOLD MINING CO. **ARIZONA.**

Office: 31 Bank of Arizona Bldg., Prescott, Ariz. Mine office: Turkey, Yavapai Co., Ariz. Employs 12 men. John Milton Sullivan, president and general manager; S. S. Ballard, vice-president; F. E. Jordan, secretary and treasurer; Geo. W. Oakman, assistant secretary and superintendent. Organized May 1, 1901, under laws of Arizona, with capitalization $3,000,000, shares $1 par. Lands, 33 claims, in three groups, area upwards of 600 acres, in the Black Canyon district, on lower Turkey creek. Has shafts of 91′, 136′ and 725′, also a 315′ tunnel, showing 3 veins, claimed by company to average 50′ in width, carrying malachite, azurite, bornite, chalcopyrite and chalcocite, said to average 5% to 5.25% copper and 2.5 oz. silver per ton. Has a 15-h. p. gasoline hoist, and is only 2½ miles from Prescott & Eastern railroad. Management plans sinking and crosscutting to determine the size of its ore bodies. Officers stand well locally, and property is considered promising.

GREAT STANDARD COPPER MINING CO. **WYOMING.**

Office: care of Colonial Security Co., 161 Summer St., Boston, Mass. Letter returned unclaimed from former mine office, Granite Canyon, Laramie Co., Wyo. Dr. Walter H. Parker, president; John Laughrey, vice-president and general manager; Chas. B. Lamont, secretary; M. E. Roberts, superintendent. Organized Sept. 30, 1902, under laws of Arizona, with capitalization $1,000,000, shares 50c. par. Lands, 17 claims, also sundry miscellaneous lands, giving total holdings of 640 acres, in the Silver Crown district, showing 6 veins of about 8′ average width, opened by 18 shallow shafts and pits, said to give average assays of circa 7% copper, from oxides, carbonates, sulphides and chlorides, with occasional native copper. Idle since March, 1904, from lack of funds.

GREAT VERDE CONSOLIDATED MINE. **CALIFORNIA.**

Office and mine: care of John Reed Lyle, manager, Sisson, Shasta Co., Cal. Is a copartnership, capitalized at $20,000, with 4 owners. Lands, 12 unpatented claims, claimed to adjoin the Balaklala mine, but actually located elsewhere, which are claimed to show an ore body of 80′ average width, claimed to carry chalcopyrite assaying 6% copper, 6 oz. silver and $7 gold per ton, opened by 5 tunnels, longest 150′. Is idle, and is not known ever to have produced any ore, statements to the contrary notwithstanding.

GREAT WESTERN COPPER CO. **ARIZONA.**

Office: Clinton, Iowa. Mine office: Tombstone, Cochise Co., Ariz. Wm. J. Young, Jr., president; Edw. Young, secretary; Paul B. War-

nekros, manager; D. W. Brown, superintendent. Capitalization, $1,000,0
Lands, 23 adjoining claims, in the Dragoon Mountains, showing argentife
copper ores. Has steam and gasoline power. Idle.

GREAT WESTERN COPPER CO. MONTAN

Letter returned unclaimed from former mine office: Butte, Silver B
Co., Mont. Organized 1906, with capitalization $1,000,000, shares $1 p
Lands, 2 claims, known as the Great Western and Henry, adjoining
Robert Emmett No. 2, on the north.

GREAT WESTERN COPPER CO. NEVAD

Office: 113 Devonshire St., Boston, Mass. Letter returned unclai
from former mine office, Reno, Washoe Co., Nev. Geo. D. Burton, pre
dent; Frank B. Cox, secretary. Organized 1901, with capitaliz
$1,000,000, shares 10c. par. Lands, 62 acres, in the Pea Vine distr
having 2 shafts, deepest 200′, and an 800′ tunnel. Vein is claimed to
2′ to 17′ in width, and to average 12% copper, with gold values, whi
not the truth. Present whereabouts of Cox, the promoter, are unkno
Stock presumably is worthless.

GREAT WESTERN GOLD CO. CALIFORNI

Office: 506 Continental National Bank Bldg., St. Louis, Mo. Mine o
Redding, Shasta Co., Cal. Employs 140 men. T. S. Henderson, presid
O. E. Adams, vice-president; M. E. Dittmar, managing director; C. J. Ba
secretary and treasurer; preceding officers, A. R. Fleming, C. P. Ba
Thos. Walsh and P. H. Noel, directors; W. G. Scott, general mana
S. E. Bretherton, general superintendent; Herbert Haas, smelter super
tendent; Jos. Wollis, mine superintendent. As near as can be ascertai
was incorporated 1901, with capitalization $10,000,000, increased, circa 19
to $12,000,000, shares $1 par. Management evades all inquiries as to c
talization and finances, though repeatedly complaining that the compa
has not been given fair treatment in preceding issues of the Copper Handbo

Lands, circa 1,600 acres, 1,290 acres patented, including the Af
thought mine, area 459 acres, the Liberty mine, Last Chance, Section
Bull and 10 other groups, also a bond and lease on the Donkey mine. Le
on the Garcia mine, Arizona, was forfeited. The Afterthought mine, in
Furnaceville district, 20 miles east of Redding, is the principal prope
and the present producer. Former developments included a 300′ shaft a
7 tunnels, of about 2,000′ aggregate length, showing a large body of l
grade sulphide ore, with occasional occurrences of medium and high-gra
sulphide ores. Company claims ore will average $30 per ton in value, wh
is a serious overestimate, as ore is chalcopyrite and sphalerite, dissemina
in iron pyrites. Main working tunnel is 848′, planned to be driven 4,50
and has cut a 20′ ore body in the Copper Hill zone, at 500′ below
crest. Mine shows considerable sphalerite, which has given assays up to 42
zinc. Title to the Liberty group, near Redding, apparently is in dispu
This property carries auriferous copper ores of undetermined value.

The smelter, 1½ miles from the mine, and connected therewith by
private railway line, has steam and electric power, and two furnaces, w

installation of a third said to be contemplated. The first furnace, 40x96" at the tuyeres, and rated at 150-tons daily capacity, was blown in, March 24, 1905. The smelter has not worked smoothly, for reasons variously given, according to bias of the commentators. It is said that management plans building a bag-house, to recover zinc oxide from the smelter fumes.

The company was promoted by T. S. Henderson & Co., a St. Louis brokerage firm of dubious reputation, and the early financiering of the Great Western Gold Company was not of a nature to recommend the property to conservative investors. The president states that $160,000 indebtedness was paid during 1905—but neglects to state how much indebtedness remains unpaid. Company has evaded all definite statements regarding its organization, finances or production. The mine may be and perhaps is good, but the Henderson management is regarded with much suspicion.

GREAT WESTERN GOLD & COPPER CO. **UTAH.**

Mine office: Park City, Summit Co., Utah. Bishop Robert Brighton, general manager. Lands, sundry claims, adjoining the Daly Judge, showing vein matter of about 100' width, giving assays of 3% to 5% copper. Is driving a tunnel, planned to cut this ore body at about 2,000' length.

GREAT WESTERN GOLD & COPPER MINING CO. **COLORADO & MONTANA.**

Office: care of W. J. Willingham, Equitable Bldg., New York. Chas. G. Eckert, president. Organized under laws of South Dakota, with capitalization $500,000, shares $1 par. Had a bond and lease on a gold claim at Cripple Creek, Colorado, also one claim, area 20 acres, near Butte, Silver Bow county, Montana, at last accounts. Company financially exhausted.

GREAT WESTERN ORE PURCHASING & REDUCTION CO. **CALIFORNIA.**

Works office: Swansea, Inyo Co., Cal. Is building a 150-ton smelter, and is said to be reopening old mines at Cerro Gordo.

GREENBACK COPPER CO. **CALIFORNIA.**

Mine office: Woody, Kern Co., Cal. Jos. Werringer, lessee. Lands, 1,520 acres, 18 miles from Southern Pacific railroad. Mine was idle from 1900 until reopened late in 1905. Country rock is grano-diorite, showing an ore chute carrying lenses of 20' maximum width, with granite walls irregularly impregnated with chalcopyrite. Development is by a 185' incline shaft, with 3 levels opened. Carbonate ores stoped from the upper levels have averaged 19.4% copper and 5.7 oz. silver per ton.

GREENE CONSOLIDATED COPPER CO. **MEXICO.**

Office: 24 Broad St., New York. Mine office: La Cananea, Sonora, Arizpe, Mexico. Wm. C. Greene, president; Mark L. Sperry, vice-president; Philip Berolzheimer, treasurer; Geo. S. Robbins, secretary; Emil Berolzheimer, W. D. Cornish, Wm. C. Greene, Henry Ollesheimer, Myron M. Parker, Alfred Romer, Mark L. Sperry, and Jacob Weidmann, executive committee; Charles Adsit, Thomas H. Anderson, Emil Berolzheimer, W. D. Cornish, W. B. Devereaux, Silas W. Eccles, W. C. Greene, Henry Ollesheimer, My-

ron M. Parker, R. W. Pillsbury, Epes Randolph, Edward C. Rice, Geo. S. Robbins, Alfred Romer, J. B. Showalter, Galen L. Stone, Mark L. Sperry, Jacob Weidmann, Eugene W. Foss, H. C. Hulbert, Thos. P. Wilson, W. A. Woodbury, L. D. Baldwin and A. Bleecker Banks, directors; Arthur S. Dwight, general manager; Geo. Young, general auditor; John McHenry, mine superintendent; David Cole, concentrator superintendent; K. J. Williams, smelter superintendent; Dr. W. J. Galbraith, chief surgeon. Employs about 4,000 men.

Organized Sept. 15, 1899, under laws of West Virginia, with capitalization (increased 1904 and 1906,) $10,000,000, shares $10 par, non-assessable. Paid dividends of $1,900,800 in fiscal year 1905, and paid total dividends of $2,812,000 to July 31, 1905. Pays bi-monthly dividends of 40 cents per share. The increase of capitalization in 1906 gave the company $3,400,000 additional cash of which approximately one-half is to be used for construction, and balance added to working capital. Fiscal year ends July 31. Has 5,226 shareholders. Stock is listed on the Boston Stock Exchange. Property represents an investment of about $12,000,000.

The mining lands of the company include 4,214 pertenencias of one hectarea each, equivalent to 10,412 acres, the tract having a boundary line of 32½ miles, and including about 40 old mines and prospects, located in the Cananea Mountains, in the free zone of northern Sonora, about 20 miles south of the Arizona border. The Cananea range is about 25 miles in length and 6 to 10 miles in width, with a northwest and southeast axis, divided into two plainly marked and nearly equal sections by Puertecitos Pass, the Greene mines being in the southern half of the range, and on a mineral belt apparently having a strike practically parallel with that of the range.

In addition to mining lands, the company also holds 486,000 acres of timber and grazing lands, leased for 8 years to the Cananea Cattle Co. The mines are in the municipality of Ronquillo, and the principal administrative buildings are in that municipality, near the smelter. The company owns the townsite of La Cananea, on the mesa to the eastward of Ronquillo, and therein are located the best dwellings, hotels and public buildings. Franchises are held for electric light, water, ice, traction and telephone services. There was much litigation over titles, but the lands were redenounced in 1902, and the Cananea Consolidated Copper Co., S. A., now holds title direct from the Mexican government, the property of the Greene Consolidated Copper Co. consisting of practically the entire stock issue of the Cananea Consolidated Copper Co., S. A., which is registered and protocolized in Mexico.

The Cananea Mountains show marked evidence of strong volcanic action, in the remote past. The mines of theGreene are found in a succession of approximately parallel outcrops of altered limestone, alternating with porphyritic dikes, the ore deposits, often of monstrous size, occurring in shear-zones between the limestone and porphyry, and as replacements in the latter. The ore bodies are entirely distinct and vary greatly, affording practically every variety of oxide, carbonate and sulphide ore, with con-

siderable native copper. Many of the ore bodies are silicious, requiring concentration to eliminate the silica, occurring as quartz, and also as aluminum silicate. None of the ore carries zinc or other refractory elements, and the process of concentration is comparatively simple. There are large gossan outcrops, but appearances are sometimes deceptive, and much of what appears gossan at a distance proves, upon closer inspection, merely weathered conglomerate, showing reddish-brown stains closely simulating the iron colors.

The mines of the Greene have about 30 miles of workings, and the ore in sight is about 4 years' supply, at the present rate of production. The mines of the Capote and Oversight zone alone contain probably 40,000,000 tons of ore, of commercial grade. The mines consume yearly, for timbering, about 40,000,000′ of Oregon pine and fir, but it is hoped to secure pine from the Sierra Madre Mountains, at a great saving from present costs, which are high. Ore extraction is by shafts and tunnels, the latter being used wherever possible, as giving cheaper mining costs. The caving system of mining, used at some Lake Superior iron ore mines, is to be given a test. The main working tunnels are double-tracked and electric-lighted throughout, and electric haulage is employed extensively.

The mineral holdings of the Greene are divided into five zones, known as the Cobre Grande, Veta Grande, Esperanza, Capote and Puertecitos, each including a number of different mines. The Cobre Grande and Puertecitos are practically idle, principal production coming from the Capote, Veta Grande and Esperanza zones, in about the order named. The mines are a network of shafts and tunnels, with eight main working shafts, and as many main tunnels.

The Cobre Grande, which was the original mine of the Greene Consolidated, was worked in a crude way, for many years, by the Pesqueira family, but is now the least important of the series. This zone shows concentrating ores only, and while the mine has more than a mile of underground workings, production is small, as its ores, though by no means to be despised, are inferior in grade to those found elsewhere in greater profusion, and more readily accessible.

The Veta Grande has two enormous ore bodies. The Veta Grande proper has a pitch of 36°, with an average width of 216′, average length of 726′ and known depth of circa 1,000′, containing at least 7,000,000 tons of high-grade ore, and probably a considerably larger tonnage. The Massey ore body, opened 1904, has been opened for 450′ width, and 1,200′ length, and is of unknown depth, this ore body assaying 7% and better in copper, with gold and silver values of about $2 per ton. The Massey ore body was opened at a point where an expert, who examined the mine, had placed a mythical "zone of impoverishment." The Veta Grande ore is mainly soft chalcocite, with a gangue of talc and occasional massive quartz, carrying large quantities of native copper and a small amount of iron pyrites, with a little massive chalcocite. Extraction is principally through an 869′ double-track tunnel, but the new Veta Grande tunnel No.

9, of 6,236′ length, serves both the Veta Grande and Oversight mines, connecting with the Capote tunnel, and accommodating 10-ton electric trams. In addition to the main ore body previously referred to, there is a 150′ ore body on the hanging wall, ranging 3% to 6% in tenor, the silicious portions of which are used for converter linings. This mine is timbered with square sets, and worked-out stopes are filled in with waste. The ore is mined in 100′ sections, leaving 100′ slices unmined, and as the worked-out stopes are filled in, it will be possible to mine out the untouched portions when the first sections are exhausted, unless the surface should be stripped previously. The Veta Grande ore bodies are overlaid by a heavy felsite capping, estimated to contain 830,000 cubic yards, and the management has given consideration to the advisability of stripping off this surface rock. Veta Grande shaft No. 5 has three compartments, operating two hoists in balance, with a 115-h. p. double hoist good for a 1,000′ depth. This shaft has a 7-drill air-compressor, smithy, timber-framing shops, etc.

The Oversight mine, served by the previously mentioned Veta Grande tunnel No. 9, has large ore bodies of excellent average grade, ranging up to 25% in copper tenor, with increased values shown on the bottom levels.

The Capote zone, including a number of mines, is the principal producer of the Greene Consolidated, and is very extensively opened. The four main shafts are known as Nos. 2, 4, 6 and 8, the deepest being about 900′, but, like the other mines, the Capotes produce principally through tunnels. The ore is rather peculiar in nature, consisting essentially of iron pyrites with a coating of chalcocite in the form of extremely thin films, the copper-coated iron pyrites occurring in thin crystalline grains, scattered quite uniformly through immense bodies of talc. The Capote ore is highly silicious, and requires careful concentration to secure the best smelting results. The main working level of the Capote zone has a double-track tunnel, connecting shafts Nos. 2, 4, 5 and 7, at an extreme distance of 2,900′. The Capote ore body has a minimum width of 165′ and a maximum width of 225′, and is estimated by the company to show 11,000,000 tons of ore, which is a conservative figure. No. 2 shaft has a 110-h. p. hoist and No. 4 has a powerful double hoist, good for a depth of 3,000′, also a 7-drill air-compressor and a 50-kw. direct-connected generator, furnishing light and power for the Capote workings. No. 10 Capote has a Prescott pump of 1,250,000 gallons daily capacity. The bottom levels are showing very well indeed, both as to quantity and quality of ore, and the mine shows richer in the "zone of impoverishment" than above.

The Elisa mine, 1,500′ south of No. 2 Capote shaft, produces a silicious chalcopyrite, rich in gold and silver. On the second level of the Elisa the vein is about 20′ wide, for a distance of some 500′, and averages 4% to 6% copper, while on the third level the vein has about the same width and carries 8% to 10% copper. The main shaft at the Elisa is 540′ in depth.

The Esperanza zone, as yet but slightly developed, is known to carry good ore bodies, and probably will be worked from the Capote shafts, at a depth of 500′ to 600′.

The Puertecitos zone, the westernmost of the group, is about 4 miles northwest of the Elisa shaft of the Capote, and is the largest ore deposit yet developed by the Greene. The ore body is of immense size, having an outcrop nearly 800′ wide. The upper workings show considerable malachite, azurite, and occasional cuprite and native copper, but the principal values, at a little depth, are in chalcopyrite, with occasional bornite, in a lime-alumina-garnet gangue. The workings of the Puertecitos zone are known as the Ventura, on the east, Juárez 1,200′ next west, and Elenita, 900′ west of the Juárez. The deepest shaft is the 700′ Ventura, and the Elenita has exposed very rich ores, in grading for surface structures. These shafts have developed ore sufficient to render each in itself a large mine.

The main power plant, near the smelter, has a 65x245′ engine-house and a 46x216′ boiler-house, both of steel, with iron sides and roof, the boiler-house having 3,500-ton coal-bunkers. The power plant has 3 engines, with direct-connected 100-kw. dynamos, and one 200-kw. direct-connected dynamo, giving a total of about 700 h. p. This plant furnishes a 250-volt current to operate the various shops, briquetting plant, silica-mill, electric cranes, etc., and also furnishes light for all mine buildings and for the towns of La Cananea and Ronquillo. The steel-frame machine shop is equipped with modern machinery, and is supplemented by a foundry having a 2-ton casting cupola. The carpenter shop and planing-mill have a complete sash-and-door equipment, and all necessary woodworking machines and tools. The warehouses are large and carry heavy stocks. Pneumatic tools are used extensively, power being furnished by Rand air-compressors.

The concentrators are on a hillside, between the mines and smelter. The old concentrator is in two independent sections, of 300 tons daily capacity each, and all material is handled by gravity, after being dumped into bins from narrow-gauge cars. The building has 3,400 sq. ft. of floor surface, and for each section the equipment includes one set of 36x14″ Davis rolls, 2 sets of 27x14″ Allis-Chalmers rolls, two 18″ bucket elevators, 10 trommels, four 36″ single Hartz jigs, two 36″ double Hartz jigs, 22 concentrating tables, 4 slime tables, 18 Frue vanners, and 3 Bryan mills for regrinding. The material is treated by wet crushing and water concentration, and much of the silicious concentrate must be briquetted before smelting. The old concentrator power-house has four 100-h. p. boilers and a tandem compound 250-h. p condensing engine, with a 300-ton coal-bin and 200,000-gallon water-storage tanks, the concentrator using about 200 gallons of water per ton of ore. The new concentrator, designed and built by Dr. L. D. Ricketts, at a cost of about $250,000, is terraced throughout, and is in four 500-ton sections. The new mills are of steel frame, with iron sides and roofs. Foundations for all machines are concrete, on rock base, independent of the wooden floors. The new mills have 2,000-ton ore-bins, and the new plant has a separate crusher building, from which the crushed ore is carried in a 36″ belt conveyor to the concentrators, native copper and chalcocite being hand-picked from the belt in transit. The new plant has 72 Frue vanners and 80 Wilfley tables, and, owing to scant water

supply, water from the coarse jigs is sent to the jig floor and used upon the middlings, and water from the middlings is used upon the sands and thence back to the coarse jigs again. From the Wilfleys the water goes to thickeners, and from the tailings the water is recovered in settling tanks, the percentage of water recovered by this ingenious combination of economies being 87.5%, which means that every gallon does duty eight times. The new concentrator puts about 3.6 tons into one, and all material is handled automatically, from the time when dumped into the bins until the concentrates are drawn off into the ore cars. Capacity of the combined concentrators, at end of 1905, was 2,400 tons of crude ore daily.

The 33x296′ furnace building, of steel frame, with iron sides and roof, has 4,200-ton ore bins and 3,000-ton coke bins. All material is handled by gravity, as far as possible. The smelter has eight Mitchell economic hot-blast air-jacketed furnaces, one of 42x120″, one of 42x180″, two of 42x210″, one of 48x120″, and three of 54x160″ at the tuyeres. Over each furnace is a 20x20x20′ steel dust-chamber, planned to collect flue-dust and return it to the smelting zone of the furnace, by gravity, but unfortunately this plan failed to work according to theory. Leaving these primary individual dust-chambers, the furnace gases go to a main dust-chamber 250x250′ in size, through a dust-flue of 10x13x400′. Smoke and gases are discharged from the main dust-chamber through a self-supporting steel stack, 16′ 6″ in diameter and 190′ high. Each blast-furnace has a 30-ton detached settler, which gives a continuous overflow into self-dumping slag-cars, of which there are 22, of 30 to 52 cubic feet capacity each, drawn by two 25-h. p. and two 40-h. p. electric locomotives.

A reverberatory furnace was added in 1905. This is the second largest in the world, having a 20x100′ hearth, with over-all dimensions of 27x120′. Its normal capacity is 350 tons of roasted ore daily, and its waste gases are burned under adjoining boilers, furnishing about 700 horse power.

Matte from the blast-furnaces is drawn off into ladles, and taken by electric cranes to the converter building, which is 60x396′, of steel frame, with iron sides and roof, having two electric cranes with double auxiliary hoists, of 40′ and 50′ span, each with a clear hoist of 40′ to the main blocks. The capacity of the conversion plant is 8,000,000 lbs. per month. There are 6 stands of converters, with 22 shells, 11′ in diameter by 13′ length, made of 1″ steel plate. The hydraulic cylinders are 24″ in diameter, with a water pressure of 200 lbs. to the square inch, and can rotate the shells through a radius of 270°. The converters blow off into movable hoods, leading to primary and secondary dust-chambers for gases. A railroad track runs under each converter stand, and the casting-cars are fitted with six 300-lb. ingot moulds each, there being 24 cars and 250 moulds. After casting, the ingots are carried in the cars to the bullion floor, where the pigs are chipped, weighed, sampled and loaded, all sampling being done by electric drills. The converter-slags are taken back in ladles, by crane, to the forehearths, thus saving resmelting. Blast for the converters is supplied by three engines, with

an aggregate of 1,700-h. p. and capacity to compress 29,750 cubic feet of free air, per minute, to a pressure of 15 lbs. per square inch.

At the eastern end of the converter building is the lining department, with silica-mill, pneumatic rammers, etc. All raw material is handled by gravity, from 600-ton silica bins. The silica mill has one 10x20″ Blake crusher, two 26x15″ Argall rolls, one 8′ automatic mixing-pan, conveyors, elevators, etc., and takes power from a 125-h. p. electric motor. For linings, low-grade silicious ores have displaced barren silica.

In the engine-house of the smelter are 3 blowing engines, one a 225-h. p. Nordberg, with 13x24″ steam cylinders and 57x57x42″ air cylinders, with capacity to reduce 20,000 cubic feet of free air per minute, and two Murray-Corliss tandem-compound blowing engines, of 125 and 375 h.p., also 3 smaller blowers, giving a total capacity of 1,100 h. p. and 92,500 cubic feet of free air per minute, compressed to a pressure of 2½ lbs. per sq. inch. The boilers have an aggregate capacity of 3,000 h. p., and there is a 12″ main steam-line into the boiler-room. Coal is fed by gravity from bins. The water-storage tanks at the smelter have a capacity of 596,000 gallons, with 9,300′ of water-mains and 4,000 of 2½″ fire-hose.

Much of the ore smelted being pulverulent, an excessive quantity of flue-dust is produced, this requiring briquetting before resmelting. The briquetting plant has a 225-ton Mould plunger press and a 100-ton White mineral press, briquettes being sent by belt-conveyors to the charging-floor of the smelter. Owing to the immense amount of material requiring briquetting, a large number of men are employed on handwork, and it is planned to erect a new briquetting plant, to have a daily capacity of 400 tons.

A sampling mill, built 1905, is of steel, with steel ore-bins and belt-conveyers. A 206x450′ ore-bedding plant, of steel, also built 1905, at a cost of about $200,000, has 30,000 tons capacity. A series of belt-conveyors distribute ores by grades, and from the bedding plant the ores go automatically to the furnaces. The new system effects a saving in smelting costs, estimated at 30 cents per ton.

Product of the smelter is auriferous and argentiferous blister copper, which is refined electrolytically by the Nichols Chemical Co., of New York, with which company the Greene has a long term contract for electrolytic refining, at the favorable rate of $15 per ton. The copper of the Greene is sold by the American Metal Co., Ltd.

The mines and works are connected by about 30 miles of wagon-road, having a maximum gradient of 7%, and there also are about 25 miles of trails. The company owns upwards of 400 horses, mules and burros, and has a large corral for their care.

The mines and works are connected by an 11-mile 36″ gauge private railroad, laid with 35-lb. and 45-lb. steel rails, and equipped with two 28-ton Porter, one 38-ton and one 40-ton Baldwin locomotives, with ten 25-ton and twelve 30-ton steel ore-cars, 3 coke cars, 4 flat-cars, 2 box-cars and a caboose. This railroad was excessively crooked, and had some 5% grades,

consequently the locomotives could haul but three loaded cars, until rebuilt throughout, with much easier grades and curves, doubling the hauling capacity of each engine. The narrow-gauge line was double-tracked, 1905, between the Capote mine and the smelter. Railroad connection with the outside world is over the Ferrocaril Cananea, Rio Yaqui y Pacifico, built by the company and sold to the Southern Pacific, a 25-year freight contract, made at the time of the sale, assuring favorable freight rates. A 90-day fuel supply is carried, to guard against shortage caused by strikes, floods, and other contingencies.

Potable water is piped from Sawmill Cañon, and water for the concentrators, boilers and other uses, is secured from a pumping plant at Ojo de Agua, on the headwaters of the Sonora river, 9¾ miles from the mine. The pumps have capacity to force 1,750,000 gallons daily through a 10″ steel pipe-line, against a head of 967′, to a reservoir on the hills above Ronquillo, whence water is delivered to the mine, reduction plant and towns, under a substantial working pressure. The water system of the company has about 25 miles of mains, ranging in size from 2″ to 10″, and owing to the cost of securing water, it is clarified and re-used, wherever possible.

The Greene owns 5 office buildings, 11 dwellings for foremen, boarding houses with capacity to care for 900 men, 6 lodging houses and about 200 cabins for miners. There are 3 boarding-houses of 10 rooms each, 1 of 16 rooms, and 1 of 42 rooms, all of brick. The company also owns a restaurant, bakery, meat-market, etc., and maintains a scavenger service in the municipality of Ronquillo. There is a two-story brick hospital, 40x100′, with detached kitchen and beds for 50 patients, also a 6-ward emergency hospital at Chivatera, and a fine club-house for employes. The mercantile plant includes a brick store, carrying an immense stock, with warehouses having direct railroad connection, and a branch store at Chivatera. The retail mercantile business of the Greene aggregates nearly $4,000,000 yearly. The company also owns and operates the Banco de Cananea, organized January, 1902, with a capital of $200,000, Mexican, which does a large and highly profitable business, Ignacio Macmanus being cashier. There is a brickyard with a daily capacity of 35,000 brick, and the company maintains a telephone system having about 200 miles of wire and about 150 phones, also an independent telephone system used for dispatching on the narrow-gauge railway. There are two sawmills, with a combined daily capacity of 14,000 feet, cutting lumber from the company's timber lands. A concession for a power plant, on the Yaqui river, has been secured from the Mexican government, and the installation of a large electric plant is under consideration.

The mines and smelter employ upwards of 4,000 men, about 85% of whom are Mexicans, with several hundred American skilled workmen, and about 300 Chinese. Wages average $3.50 to $4 gold per day for Americans, and about $3 silver per day for Mexican miners, this being the highest wages paid native workmen by any Mexican mine. A "race-war," occurring in May, 1906, was much exaggerated in the press, though sufficiently serious.

The rioting, which was speedily quelled by Gov. Ysabal, of the state of Sonora, with the able assistance of Col. Emilio Kosterlitzky, of the gendarmeria fiscal, was caused by professional agitators and would-be revolutionists, who selected La Cananea for their efforts, because of its proximity to the American border—and safety—the Mexican government having a way of promptly shooting rioters and revolutionists first, and trying them later on, when time hangs heavy.

The Greene Consolidated Copper Co., and its president, Col. Wm. C. Greene, have been the targets for more lies than ever before have been directed at any mining company. The campaign of slander was conducted systematically, for nearly 5 years, but was broken by the confession of a treacherous director, who admitted his guilt, and that he had been made a catspaw. The management of the Greene is human, and has made mistakes, but the deliberate attempts to ruin the company, and destroy the reputation of its founder, have reacted upon the assailants, creating sympathy for the property and management so wantonly and untruthfully assailed. The Greene Consolidated, located in what was a wilderness in 1898, but is a city of 23,000 souls in 1906, was created in double-quick time. Mistakes were made, but financial conditions were such that haste—which means waste—was unavoidable. The errors have been repaired, in the main, and those that remain are being made right by the present capable management. It would have been better had dividends been begun several years later than was the case, but the explanation is not far to seek. Fighting for the financial lives of his company and himself, Col. Greene was forced to begin paying dividends from funds that better could have been put back into the mine and its equipment. An enterprise so vast as the Greene absorbs money as a sponge sucks up water, hence the various increases of capital.

In the fiscal year 1905, production was 64,211,895 lbs. fine copper, made at a cost of about 11 cents per pound, and production will show little change for 1906. The combined capacity of the concentrator and smelter is about 4,000 tons of raw ore daily. The policy of treating lower grade ores has brought the average tenor of ore treated, from 5.73% in 1903, and 4.98% in 1904, down to 3.84% in 1905.

GREENE GOLD-SILVER CO. **MEXICO.**

Office: 24 Broad St., New York. Mine office: Temosáchic, Chihuahua, Mexico. Col. Wm. C. Greene, president; Mark L. Sperry, vice-president; E. J. Gates, treasurer; Richard A. Jones, secretary; John H. Martin, assistant secretary and treasurer; Frank Kiepetko, consulting engineer; C. C. Chase, general mine superintendent; W. E. Pomeroy, Edward Massey, N. J. Welch, Foster Kipp, S. N. Dedrick, Sam King and G. M. Hillary, superintendents of various mines; New York Trust Co., registrar: North American Trust Co., transfer agent. Organized November 10, 1902, under laws of West Virginia, with capitalization $15,000,000, increased, March, 1906, to $25,000,000, shares $10 par, in $3,000,000 preferred 8% stock and $22,000,000 common stock.

Landed holdings are among the most extensive possessed by any mining company in the world, including a government concession to locate mines in an area of upwards of 4,000 square miles, in the states of Chihuahua and Sonora, Mexico. Company holds a large number of developed and partly developed gold, silver, copper and lead mines, including the Guaynopita, Santa Juliana, Balvanera, Mulatos, Veta Grande, Cerro Boluda and numerous other mines, located at Temosáchic, Mulatos, Trinidad, Colón, Santa Juliana, Belen, San Refugio, Santa Brigida, Natividad and elsewhere, in the states of Chihuahua and Sonora, giving a chain of properties from El Paso to the Pacific. Properties controlled by this company have produced upwards of $120,000,000, mainly from surface workings. There are 11 different reduction plants on 11 different properties, and new plants of a more modern nature are planned, and under construction.

Holdings in the Jesús Maria district, Ocampo, Chihuahua, include the Santa Juliana, Balvanera, Guadalupe, Rincón and Ronquillo groups. The Santa Juliana has produced upwards of $100,000,000, according to government records, and shows a vein ranging up to 50′ width, opened to 900′ depth, which is approximately the water-level. The mine has been reopened by a double-track drainage tunnel, which will unwater this and adjacent properties, to a depth of circa 1,500′. Equipment includes an old stamp mill.

The Balvanera, adjoining the Santa Juliana group, in the Canton of Rayon, Chihuahua, has a 40-ton mill and concentrator. This group has produced upwards of $3,000,000, and includes 44,000 acres of pine and oak timber lands, of good quality, with numerous buildings and various other surface improvements.

The Guaynopita copper mines, located in Guaynopita Cañon, Chihuahua, near the Sonora line, were worked by the Aztecs before the conquest of Mexico. Ores carry good values in gold, silver and copper, and it is planned to erect a 500-ton smelter at this property.

The Mulatos group, in the Sahuaripa district of Sonora, is said to have produced upwards of $18,000,000, mainly in gold, from arastras and a 60-ton mill now on the property. The vein is of enormous size, ranging up to 500′ in width, and the company plans the installation of a 2,500-ton mill. The Mulatos group includes mineral rights to 6,400 acres, also 2,400 acres of timber lands.

Miscellaneous holdings include the Veta Grande gold mines, adjoining the Pinos Altos, and the Cerro Boluda group of gold mines, also a large number of smaller old mines.

In addition to mineral lands, the company possesses extensive tracts underlaid by coal of good quality and existing in large quantity. Miscellaneous concessions from the Mexican government allow the free importation of mining material, and exemption from taxation for several years. The company also has concessions for utilizing water power from the Aros and Yaqui rivers, and has concessions for constructing telegraph and telephone lines and other public utilities.

The holdings of this company are so extensive that years will be required to provide for their adequate development. Work now under way includes the construction of wagon-roads to sundry mines, radiating from Temosáchic, which has a railroad. A 300-ton mill has been built at Concheño, Chihuahua, and a 200-ton smelter is planned for the townsite of Dedrick, at the Santa Boluda mines. The management expects to be producing about 1,000 tons of gold ores, averaging $15 per ton, by 1907, and by that time should be a considerable producer also of silver, lead and copper ores. Management is good, and the property is one of almost infinite possibilities.

GREEN HOPE MINING & MILLING CO. **WYOMING.**

Office: Omaha, Neb. Mine office: Guernsey, Laramie Co., Wyo. Lands, sundry claims in the Hartville district. Company is said to have planned erecting a 200-ton smelter, at Guernsey, but no such smelter built. Idle.

GREENHORN COPPER MINING CO. **COLORADO.**

Mine office: Cañon City, Fremont Co., Colo. Mrs. Wm. E. Johnson, administratrix, Metropole Hotel, Denver, Colo., is the principal shareholder, and practically manager of the company. Lands, sundry copper claims, 12 miles from Cañon City, on which some development has been secured, showing low-grade copper ores. Presumably idle.

GREEN MONSTER MINE. **CALIFORNIA.**

Office: care of D. C. Riddell, owner, Gilroy, Cal. Mine, in Inyo county, California, has a 300′ tunnel, showing good copper ore. Idle.

GREEN MONSTER MINE. **NEVADA.**

Office: care of Mrs. Phœbe Hearst, owner, San Francisco, Cal. Mine office: Sandy, Lincoln Co., Nev. Frank O. Wilkinson, superintendent. Mine is opened by a 325′ two-compartment vertical shaft, showing carbonate and sulphide ores, latter including argentiferous galena and chalcopyrite. Mine has been claimed to show about 5,000 tons of $40 ore.

GREEN MOUNTAIN COPPER CO. **NEW MEXICO.**

Office: 1013–135 Adams St., Chicago, Ills. Mine office: Rinconada, Rio Arriba Co., N. M. Adrian Vandercloot, president; F. E. Roberts, Jr., secretary; T. F. Woody, mine manager. Organized March 18, 1903, under laws of New Mexico, with capitalization $2,000,000, shares $1 par; issued, $1,781,900. Lands, 8 claims, area 180 acres, in the Copper Mountain district, showing two contact veins between slate and quartzite, claimed to average 30′ width and to be traceable 4,000′, carrying oxide and carbonate ores, giving assays of 4% to 37% copper, from a trace to 800 oz. silver and 80c. gold per ton. Has 13 shafts, deepest 250′, also a 210′ tunnel and an open-cut, with 758′ of underground workings, estimated by management to show 40,000 tons of ore. Nearest railroad, 8 miles. Presumably idle.

GREEN MOUNTAIN COPPER MINING CO. **WYOMING.**

Property sold, circa 1904, to Saginaw Valley Copper Mining Co.

GREEN MOUNTAIN MINE. **CALIFORNIA.**

Office and mine: Lewis, Mariposa Co., Cal. O. R. Sydney, owner and manager. Mine produced a considerable amount of high-grade oxide and carbonate ores, before closing, 1863, and shows a promising ore body.

slightly developed, but apparently could be worked open-cast, to advantage.

GUANAJUATO COPPER CO. **MEXICO.**

Said to have copper claims in the vicinity of Guanajuato, Mexico, but careful investigation has not located the property.

GUARDIAN COPPER MINING CO. **MONTANA.**

Out of business. Lands sold, 1906, to Butte Coalition Mining Co.

GUAYNOPA SMELTING & REDUCTION CO. **MEXICO.**

Merged, 1904, in International Consolidated Smelting & Mining Co.

GUAYNOPITA COPPER CO. **MEXICO.**

Entire stock issue owned by Greene Gold-Silver Co.

GUERRERO DEVELOPMENT CO. **MEXICO.**

Office: care of A. H. Ten Broeck, secretary and treasurer, San Francisco, Cal. Mine office: Chilpancingo, Guerrero, Mex. W. R. Price, president; J. J. Moylan, vice-president; J. S. Cannon, general manager; E. J. Reynolds, superintendent. Is developing by a tunnel, on the Veta Madre, above Chilpancingo.

GUGGENHEIM EXPLORATION CO. **U. S. A. & MEXICO.**

Controlled by American Smelters Securities Co.

GULF CREEK, LTD. **AUSTRALIA.**

Voluntarily liquidated, November, 1904.

GULF CREEK MINE. **AUSTRALIA.**

Mine office: Barraba, N. S. W., Australia. Lands, 250 acres, in the Gulf Creek district of the Barraba division, 350 miles north of Sydney and 72 miles from a railroad. Ore bodies include a 9′ vein of 7% sulphide ore, also a 10% lense of sulphide ore 25′ wide and 350′ long. Ore is very heating, being rich in sulphur. Country rocks are indurated clay-slates, of Carboniferous age, with dikes of serpentine. Has steam power and a 300-ton smelter. Production, 1901, was 560 long tons fine copper, from 9,400 tons of ore smelted. Idle.

GUM TREE GOLD MINING & MILLING CO. **COLORADO.**

Mine office: Idaho Springs, Clear Creek Co., Colo. J. F. Antisdale, superintendent, at last accounts. Ores carry gold, silver lead and copper. Has steam power.

GUNN'S PEAK COPPER MINING CO. **WASHINGTON.**

Office: 217 Columbia St., Seattle, Wash. Mine office: Index, Snohomish Co., Wash. A. M. Watt, superintendent. Lands, 4 claims, showing 3 veins, widest said to be 25′, carrying chalcopyrite and bornite, said to give average assays of 11% copper and circa 2 oz. silver per ton. Has tunnels of 125′ and 800′, and was developing actively, early in 1906.

GUNSIGHT GROUP. **ARIZONA.**

Sundry undeveloped claims, lying near the Crescent property, in Tombstone Cañon, north of Bisbee, Cochise county, Arizona.

GWIN MINE DEVELOPMENT CO. **CALIFORNIA.**

Mine office: Gwinmine, Calaveras Co., Cal. David McClure, superintendent. Is a gold mine, but possesses also a large body of undeveloped copper ore, of low grade. Paid a 25c. dividend, February, 1906, being the

first in 2 years, and is said to be producing at rate of about $500,000 yearly.

GWYNANT COPPER MINES CO., LTD.

Dissolved. January, 1905.

GYMPIE COPPER MINES, LTD. **AUSTRALIA.**

Voluntarily liquidated. May, 1904.

HADLEY CONSOLIDATED COPPER CO. **ALASKA.**

Office: 609 Mutual Life Bldg., Seattle, Wash. Mine office: Hadley, Prince of Wales Island, Alaska. Employs 30 men. Samuel I. Silverman, president; B. E. Barinds, vice-president and treasurer; Nelson W. Parker, secretary; preceding officers, W. S. Grinsfelder, Alex. Reith and Geo. Browne, directors; Geo. E. Green, superintendent; Robt. Pollock, mine superintendent. Organized circa 1904, as successor of Wales Copper Mining Co., with capitalization $5,000,000, shares $1 par, in $1,500,000 preferred and $3,500,000 common stock. Paid a dividend of 1 cent per share, on preferred stock, amounting to $15,000, on December 10, 1905, and a similar dividend, January, 1906, ending 1905 with a cash balance of $18,846.

Lands, 12 claims, partly patented, area circa 200 acres, on Mount Andrew. The principal property, known as the Stevenson mine, has a very large ore body, claimed to be 250′ wide and 600′ long, developed by 555′ of tunnels and 3 glory-holes, and is said to have 58,500 tons of ore blocked out for breaking. Smelter shipments, 1905, gave returns of 3.7% copper, 20 cents silver and $1 gold per ton. Ore carries 32% iron and is practically self-fluxing. Mine is connected with the smelter of the Alaska Smelting & Refining Co., at Hadley, circa 2 miles distant, by railway and aerial tram. Production, 9,439 tons, in 1905, gave returns of $55,923, with 698,486 lbs. fine copper. At beginning of 1906 company was shipping 100 tons daily, and earning a profit of about $6 per ton therefrom. Management seems conservative and capable, and property is considered valuable.

HAGGARTY COPPER MINING CO. **WYOMING.**

Controlled, through stock ownership, by Penn-Wyoming Copper Co.

HAGGARTY-JORDAN COPPER MINING CO. **WYOMING.**

Office: Watertown, N. Y. Mine office: Battle, Carbon Co., Wyo. C. H. Dunbar, president; Delos S. Dunbar, secretary and treasurer. Organized 1901, under laws of Delaware, with capitalization $150,000, shares 10c. par. Lands, 11 claims, area 220 acres, in the Battle Lake district, showing 4 fissure veins, of which two, very slightly developed, are claimed, untruthfully, by the management, to carry carbonate and sulphide ores with average values of 35% copper, a trace of silver and $5 gold per ton. Company suffered a mysterious "burglary," by which all its books and papers were stolen. Moribund, and should be decently interred.

HAGUE & HULBERT EXPLORATION. **MICHIGAN.**

Office: care of Jas. D. Hague, 18 Wall St., New York. Lands, 240 acres, in Sections 25 and 26, Town 50 North, Range 33 West, bought, 1905, of the Sheldon Estate and the C. C. Douglas Co. It is probable that additional lands will be acquired, and exploratory work begun.

HALIFAX COPPER CO. **VIRGINIA.**

Office and mine: Virgilina, Halifax Co., Va. Property is the Wall mine, which shipped a little ore, 1900. Idle at last accounts.

HALLIWELL COPPER CO. **MICHIGAN.**

Office: Society for Savings Bldg., Cleveland, Ohio. Mine office: Ontonagon, Ontonagon Co., Mich. Idle. A. H. Weed, president; John Beeker, vice-president; Chas. W. Voth, secretary; C. F. Uhl, treasurer. Organized January, 1895, under laws of West Virginia, and reorganized, 1901, under laws of South Dakota, with capitalization $3,000,000, shares $1 par; bonds, $6,500 issued. Lands, 880 acres, owned in fee, in Carp Lake township, carrying sundry copper bearing amygdaloids, with shafts of 130′ and 190′, and tunnels of 190′ and 200′. Has a 60-h. p. steam plant, with hoist and 3-drill air-compressor. Buildings include a machine shop, shafthouse, rockhouse, smithy and sawmill.

HALL MINING & SMELTING CO., LTD. **BRITISH COLUMBIA.**

Offices: 1, Leadenhall St., London, E. C., Eng. Mine office: Nelson, B. C. Employs 125 men. Lord Ernest W. Hamilton, chairman; C. Harvey, consulting engineer; A. E. Ashley, secretary; J. J. Campbell, business manager; M. S. Davis, mine superintendent. Organized June 6, 1900, as a reconstruction of Hall Mines, Ltd., with capitalization £325,000, shares £1 par; issued, £275,000. Debentures, £50,000 authorized; issued, £24,560, first mortgage 6% bonds, redeemable at 105, on 6 months' notice, at option of company. Lands, 18 claims, area 506 acres, also a 40-acre smelter-site, on Toad Mountain, including the Silver King, Hall and Highland mines, also a quarter interest in the Emma mine, near Summit. Mines produce auriferous and cupriferous silver-lead ores, the Silver King carrying bornite above and argentiferous tetrahedrite below, the lower levels not looking so well as the upper workings.

The Silver King, down to the seventh level, and two other properties, are leased to M. S. Davys, on royalty, until June 30, 1907. Ore produced is mainly silver-lead, with a little copper.

The reduction plant, near the mine, includes sampling mill, laboratory and smelter, latter having one large and one small furnace, originally built for copper, but now used mainly for lead matting. The smelter has hand and mechanical roasters. Production, for fiscal year ending June 30, 1905, was 26,505 tons of ore, of which 17,257 tons were smelted in the company's own furnace, and the balance sent to other smelters. Latest reported figures of copper production were 318,124 lbs., for fiscal year 1904.

CLEMENTE HAM. **MEXICO.**

Mine office: Promontorios, Alamos, Sonora, Mex. Is a producer of copper ores, which are smelted to matte near the mine. Production, 1902, was 191.2 metric tons matte, presumably averaging about 55% in copper tenor.

HAMILTON MINING CO. **MICHIGAN.**

Wound up. Lands sold to Copper Crown Mining Co. of Michigan.

HAMILTON MINING, MILLING & TRANSPORTATION CO. **COLORADO.**

Mine office: Winfield, Chaffee Co., Colo. John G. Paine, superintendent,

at last accounts. Ores carry copper, silver and gold, and are developed by shaft and tunnels.

HAMLEY COPPER MINE. **AUSTRALIA.**

Office: care of John S. Scott, secretary, Grenfell St., Adelaide, South Australia. Mine office: Moonta, Yorke Peninsula, South Australia. Mine, opened 1861, under name of Karkarilla, shows 6 parallel veins, of 3′ average width, carrying mainly bornite and chalcopyrite, with occasional chalcocite, ores averaging about 3.8% copper. Deepest shaft is 1,020′. Production, 1904, was circa 500,000 lbs. fine copper.

HAMMOND COPPER CO. **MONTANA.**

Letter returned unclaimed from former office, 18 Broadway, New York. Lyman M. Loomis, president and treasurer; Joseph Howard, secretary. Last heard of company was a charge of fraud, preferred against officers by a Baltimore shareholder, in 1902. Presumably dead.

HAMPDEN CLONCURRY COPPER MINES, LTD. **AUSTRALIA.**

Mine office: Cloncurry, North Queensland, Australia. Organized 1906. Mines include the Hampden, which shows large sulphide ore bodies, and from which 528 long tons of selected ore, shipped, 1901, to the Wallaroo smelter, gave returns of 36.5% copper. Mines are hampered by lack of rail transportation, or smelter in the vicinity, but property is considered promising.

HAMPDEN COPPER MINES. **AUSTRALIA.**

Succeeded, 1906, by Hampden Cloncurry Copper Mines, Ltd.

HAMPTON MINE. **COLORADO.**

Mine office: Central City, Gilpin Co., Colo. W. C. Hughes, manager, at last accounts. Ores carry gold, silver and copper. Has steam power.

HANAWA MINE. **JAPAN.**

Owned by Mitsu Bishi Gosshi Kwaisha.

HANCOCK CONSOLIDATED MINING CO. **MICHIGAN.**

Mine office: Hancock, Houghton Co., Mich. John D. Cuddihy, president; Thos. Hoatson, vice-president; preceding officers, Jas. Hoatson, S. B. Harris and Allen F. Rees, directors; John H. Hicok, secretary and treasurer; John L. Harris, superintendent. Capitalization $5,000,000, shares $25 par, of which it is planned to issue 100,000 shares at $10, and pay $500,000 for property, leaving $500,000 in the treasury for development purposes. Lands, 860 acres, including the old Hancock mine, area 140 acres, the Condon tract of 120 acres, and 600 acres secured from St. Mary's Mineral Land Co. These tracts carry the Hancock or Sumner lode, the Quincy "west vein" and the Pewabic lode, all amygdaloidal cupriferous beds. Several millsites are under consideration.

The old Hancock mine, operated 1861-1885, produced 2,854 tons, 1,384 lbs. fine copper. Development is by a shaft of 1,052′ and an old air-shaft. It is planned to cut the main shaft down to 3-compartment size and add a modern mining equipment. The Hancock lode averages circa 12′ width, and gave average returns, when worked, of 21 lbs. fine copper per ton. During its latter years of activity, the monthly mineral product was about 50

tons, secured from an average daily production of 210 tons of rock. The best part of the Quincy mine is tributary to No. 7 shaft, which adjoins the Hancock boundary. The Quincy Mining Co. claims the right to mine the Pewabic lode on the lands of the old Hancock Mining Co., and the latter claims that the Quincy has done considerable unauthorized mining on its lands. There is a possibility that the Hancock Consolidated Mining Co. may be merged with the Quincy Mining Co., failing which, it is almost certain that there will be prolonged litigation over mining rights, between these two corporations. The management of the Hancock Consolidated is strong and capable, and prospects of the company are considered good.

HANCOCK COPPER MINES OF IDAHO, LTD. **IDAHO.**

Office: care of John Sennett, treasurer, Washington, D. C. Mine office: Landore, Washington Co., Idaho. C. F. Drake, president and general manager; J. J. Curtis, vice-president; Geo. A. Rahm, secretary. Organized 1905, with capitalization $1,000,000. Lands, 10 claims, on Camp Creek, 2 miles from Landore, developed by a tunnel, said to show considerable bodies of auriferous copper ore. Company is said to plan experimenting with a newly patented reduction process.

HANCOCK MINES CO. **NEW MEXICO.**

Letter returned unclaimed from former office, St. Louis, Mo.

HANCOCK MINING CO **MICHIGAN.**

Succeeded, 1906, by Hancock Consolidated Mining Co.

HANE COPPER MINING CO. **MONTANA.**

Letter returned unclaimed from former office, Butte, Montana.

HANOVER COPPER CO. **NEW MEXICO.**

Office: 1502-11 Broadway, New York. Charles W. White, president and treasurer; R. K. Wartman, secretary. Organized under laws of South Dakota, with capitalization $1,000,000, shares $100 par. Company expended about $75,000 on development of mining claims near Hanover, Grant county, New Mexico, but work was done under inexperienced management, and company allowed title to lapse, through non-payment of balance due on bond, meanwhile securing sundry other claims, presumably in same neighborhood, on which no mining has been done as yet.

HANOVER MINE. **NEW MEXICO.**

Office: Hanover, Grant Co., N. M. Robert Musgrove, superintendent. Is being worked, with a force of about 25 men, by Phelps, Dodge & Co., ores produced from old workings being shipped to the Copper Queen smelter, at Douglas, Arizona.

HANOVER MINING CO. **MICHIGAN.**

Office: 68 Devonshire St., Boston, Mass. F. H. Raymond, president; C. O. Burbank, secretary and treasurer. Lands, 320 acres, being the West ½ of Section 8, Town 58 North, Range 28 West, Keweenaw county, Michigan. Never a producer, and idle for many years.

HANOVER MINING & MILLING CO. **NEW MEXICO.**

Letter returned unclaimed from former office, Albuquerque, N. M. Mine office: Hanover, Grant Co., N. M. J. W. Bible, manager.

HAPPY JACK MINING CO. **ARIZONA.**

Mine office: Patagonia, Santa Cruz Co., Ariz. W. H. Barnett, superintendent, at last accounts. Mine is opened by shaft and tunnel, showing ores carrying gold, silver, copper and lead values. Presumably idle.

HAPPY JOHN MINE. **BRITISH COLUMBIA.**

Mine office: Alberni, Vancouver Island, B. C. Property adjoins the Monitor mine, on the west, and is said to have a promising ore body carrying gold, silver and copper values. Did 175′ of tunneling, 1904.

HARDSCRABBLE MINES. **NEW MEXICO.**

Office and mine: Magdalena, Socorro Co., N. M. W. A. Brown, lessee. Property shows 9 veins, occuring as fissures in granite and as contacts between granite and limestone, these being claimed to average about 25′ width, and to carry chalcopyrite, sphalerite and cerussite averaging about 4% copper, 30% lead, 44% zinc, 12 oz. silver and $1 gold per ton. Mines have a 200′ shaft and several tunnels, longest 200′ and 300′.

HARLEY GOLD MOUNTAIN MINING & SMELTING CO. **WASHINGTON.**

Office 704 New York Blk., Seattle, Wash. Mine office: Darrington, Snohomish Co., Wash. Employs 15 men. Charles Burns, president and treasurer; Harley E. Burns, vice-president; Henry S. Noon, secretary; K. O. Neste, general manager. Organized December 15, 1900, under laws of Washington, with capitalization $2,500,000; issued, $1,500,000. Lands, 16 claims, area 300 acres, in the White Horse district, showing 12 ore bodies, occurring as fissures in porphyry and as contact veins between granite and porphyry. Four veins are under development, these being said to average 6′ width and to carry 14.5% copper, 8 oz. silver and $25.65 gold per ton. Development is by tunnel, with 346′ of openings. Company plans adding a steam plant, during 1906.

OTTO HARNECKER. **CHILE.**

Office and mine: La Ligua, Aconcagua, Chile. Operates the Peña Blanca mine, opened 1888. Has a small matting furnace and produces matte carrying about 350,000 lbs. fine copper yearly.

HARRINGTON MINING CO. **ARIZONA.**

Mine office: Crown King, Yavapai Co., Ariz. Geo. P. Harrington, general manager. Property is the Tiger mine, carrying ores of gold, silver and copper. Has steam power. Presumably idle.

HARTFORD CONSOLIDATED COPPER CO. **CALIFORNIA.**

Lands, 10 claims, 3 miles north of Protem Creek, Shasta county, California, carrying an 8′ vein, showing surface oxidized ores with a limited quantity of disseminated sulphides below, opened by 400′ of tunnels. Idle.

HARTFORD COPPER & GOLD MINING CO. **ALASKA & IDAHO.**

Office: 7 Exchange Pl., Boston, Mass. Mine office: Challis, Custer Co., Idaho. Henry J. Wilkins, president; Chas. M. Thayer, secretary. Capitalization $2,000,000. Claims to have copper lands on Prince of Wales Island, Alaska. Had an option on a mine in Idaho, and paid dividends while peddling stock. Lost the Idaho mine, and management being bad, and property problematical, stock may be considered valueless.

HARTWIG MINING CO. **IDAHO.**

Office: care of Dr. R. A. Nash, president, Tipton, Iowa. Mine office: Pollock, Idaho Co., Idaho. Organized 1905, under laws of Iowa, with capitalization $72,500. Property shows a contact copper vein, 3′ wide at surface, and 12′ wide in a 100′ tunnel. Formation is granite and limestone, vein carrying $1.50 to $72 per ton values, mainly in copper, with an average of about $1.50 silver and $4 gold per ton. The 875′ lower tunnel has cut the ore zone, but shows very little ore.

HARVARD MINE. **ARIZONA.**

Mine office: Gilbert, Yavapai Co., Ariz. W. P. Hamlin, et al., owners. Ores carry gold, silver and copper. Has gasoline power. Presumably idle.

HASSAYAMPA GOLD & COPPER MINING CO. **ARIZONA.**

Office: 202 North Ninth St., St. Louis, Mo. From title, lands, if any, presumably are located in Yavapai county, Arizona.

HASKINS MINING CO. **ARIZONA.**

Mine office: Tucson, Pima Co., Ariz. Lands are sundry claims in the Tucson Mountains.

HATASA MINE. **JAPAN.**

Mine office: Hatasa-mura, Gujo-gori, Mino, Japan. Is an old property, opened previous to A. D. 1600, and once was highly productive. Has 4 principal veins, 3″ to 2′ in width, carrying argentiferous copper and lead ores, associated with sphalerite, iron pyrites, etc. Production, 1900, was 165,416 momme of silver and 38,651 lbs. fine copper.

HATHAWAY MINE. **MEXICO.**

Mine office: Santo Domingo, Chihuahua, Mex. Lands, 18 miles south of Santo Domingo, show two small but persistent veins, carrying rich sulphide ores. Has an old smelter, not in blast, and ships concentrates to Aguascalientes, for reduction, when working. Presumably idle.

HATTIE BELL COPPER, GOLD & NICKEL MINING CO. **ONTARIO.**

Dead. Lands sold to Consolidated Copper Co. of Parry Sound.

HATTIE GOLD AND COPPER MINING CO. **IDAHO.**

Letter returned unclaimed from former mine office, Doniphan, Idaho.

HAWKEYE COPPER MINING CO. **WYOMING.**

Office: 519 Equitable Bldg., Denver, Colo. Letter returned unclaimed from former mine office, Encampment, Carbon Co., Wyo. Joseph A. Michel, president and treasurer; Geo. C. Waterman, secretary. Organized 1900, under laws of Wyoming, with capitalization $500,000, shares $1 par. Lands, 2 claims, area 40 acres, having a 35′ shaft. Presumably idle.

HAWKEYE MINE. **OREGON.**

Office and mine: care of Byron Sherbindy, owner, Comer, Grant Co., Ore. Mine carries auriferous and argentiferous copper ores, and property is said to have a small smelter. Presumably idle.

HAXWORTH COPPER CO. **ARIZONA.**

Mine office: Agua Caliente, Maricopa Co., Ariz. Lands, 25 claims. Idle.

HAYES MINE. **BRITISH COLUMBIA.**

Owned by Nahmint Mining Co.

HAYFORD MINES, LTD. **ENGLAND.**

Voluntarily liquidated, February, 1905.

HAYMAN MINING & TUNNEL CO. **COLORADO.**

Mine office: Tarryall, Park Co., Colo. Lands, sundry claims, said to show lead and copper ores. Presumably idle.

HEADLIGHT COPPER MINING CO. **WYOMING.**

Letter returned unclaimed from former office and mine, Encampment, Carbon Co., Wyo.

HEADLIGHT GOLD MINING & MILLING CO. **COLORADO.**

Mine office: Spencer, Gunnison Co., Colo. L. C. Ehbeding, superintendent, at last accounts. Ores carry gold, silver and copper. Has steam power.

HEALDSBURG LODE. **CALIFORNIA.**

Office and mine: care of J. G. Caldwell, manager, Healdsburg, Sonoma Co., Cal. Lands, 1 claim, 10 miles north of Healdsburg. Opened, circa 1885, by tunnel. Idle at last accounts.

HEART OF ARIZONA GOLD & COPPER CO. **ARIZONA.**

Letter returned unclaimed from former office, Detroit, Mich. Mine office: Prescott, Yavapai Co., Ariz. Organized 1902, under laws of Arizona, with capitalization $1,000,000. Idle at last accounts.

HEATH MINING CO. **IDAHO.**

Letter returned unclaimed from former mine office, Heath, Idaho.

HECLA & ARIZONA DEVELOPMENT CO. **ARIZONA.**

Title changed, 1903, to Red Jacket & Bisbee Development Co.

HECLA & ARIZONA GOLD & COPPER MINING CO. **ARIZONA.**

Office: care of J. M. Carroll, Weatherford, Texas. Organized 1902, to take over claims near Bisbee, Cochise county, Arizona. Idle.

HECLA CONSOLIDATED MINING CO. **MONTANA.**

Office: Indianapolis, Ind. Mine office: Dillon, Beaverhead Co., Mont. Henry Knippenberg, president and general manager. Property includes the Atlantis, Cleve and other mines, carrying auriferous and argentiferous copper and lead ores. Was a large producer, for many years, making circa 100,000 pounds copper yearly, as a by-product, and paid dividends of $2,250,000, without assessments, on an original investment of $40,000, but the shareholders refused to liquidate a $30,000 indebtedness, and property was sold by sheriff and bid in by sundry shareholders. Attempts at reorganization have been unsuccessful, and property is for sale.

HECLA COPPER & GOLD MINING, MILLING & SMELTING CO. **WYOMING.**

Reorganized, October, 1904, as Hecla Mining Co.

HECLA COPPER MINING CO. **WYOMING.**

Letters returned unclaimed from former office, Manistee, Mich., and former mine office, Encampment, Carbon Co., Wyo. Lands were 4 claims, area circa 30 acres, adjoining the Kurtz-Chatterton.

HECLA MINES. **WASHINGTON.**

Office: care of F. Danel, 217 Columbia St., Seattle, Wash. Lands, sundry claims, in vicinity of Seattle. Idle for several years.

HECLA MINING CO. **WYOMING.**

Office: 1624 Curtis St., Denver, Colo. Mine office: Hecla, Laramie Co., Wyo. Henry Schwartz, president and general manager; Geo. C. Norris, vice-president; Louis Williams, secretary; Geo. L. Bettcher, treasurer. Organized October, 1904, under laws of Wyoming, as a reconstruction of the Hecla Copper & Gold Mining, Milling & Smelting Co., with capitalization $1,000,000, shares $1 par. Lands, 16 claims 2 patented, and a 45-acre millsite, area 365 acres, including the townsite of Hecla, 5 miles from a railroad, in the Silver Crown district, showing 16 fissure veins, averaging 8′ width, in schist and granite, of which 3 are being developed, these averaging 7′ width and giving average assays of 5% copper, 3 oz. silver and $10 gold per ton, in addition to which they carry estimated average values of $10 to $12 per ton in nickel, platinum and uranium. Ores are oxides, carbonates and sulphides, opened by a 40′ tunnel and 14 shafts of 10′ to 140′ depth. Has steam power, 15-stamp mill and 50-ton concentrator and leaching plant, in a building 80x100′. The Ohly process was installed, with a view to saving the rare metals in the ore, but was not a success. It is strange, how new mining companies, with no cash to spare, will experiment with new and untried reduction processes, to their own detriment or destruction. Ore is mainly low grade, part of which will concentrate, while part will not.

The management was well spoken of, in the last annual edition of the Copper Handbook, but since that time the company has begun peddling "guaranteed" stock, for which reason the commendatory words regarding the management are hereby withdrawn. Any mining company that sells "guaranteed" stock is guilty of what perilously approaches a fraud upon its shareholders, and its stock should be let severely alone.

GEWERKSCHAFT HEDWIGSGLÜCK. **GERMANY.**

Office: Düsseldorf, Germany. Mine office: Rheinbach, Kreis Bruhl-Unkel, Rheinprovinz, Germany. Lands, 437.7 hectares, carrying copper, lead and zinc ores, developed by 2 shafts.

HELEN MINING CO. **NEW MEXICO.**

Mine office: Graham, Socorro Co. N. M. Thos. Graham, president. Property is the Confidence group, ores of which carry gold, silver and copper. Has a 30-stamp mill, and is equipped with steam, water and electric power.

HELGA GOLD COPPER CO. **BRITISH COLUMBIA.**

Office: Sullivan Bldg., Seattle, Wash. Mine office: Clayoquot, Vancouver Island, B. C. Property is the Good Hope group, on Trout river, developed by a tunnel, said to give a fair showing of ore.

HELSINGBORG'S KOPPARVERK, **SWEDEN.**

Is the refining plant of the Sulitelma Aktiebolag, at Helsingborg, Malmöhus Län, Sweden.

HELVETIA COPPER CO. **ARIZONA.**

Office: 27 State St., Boston, Mass. Mine office: Helvetia, Pima Co., Ariz. Employs circa 200 men. Wm. A. Paine, president; Frederic Stanwood, vice-president; Fred. B. Close, general manager; C. F. Shelby, con-

sulting engineer. Organized March 3, 1899, under laws of New Jersey, and reincorporated, 1905, under laws of Arizona, with capitalization $5,000,000, shares $25 par, $10 paid in. Old Colony Trust Co., Boston, transfer agent. Annual meeting, third Wednesday in February. Lands, 55 patented claims, area 1,100 acres, also 900 acres miscellaneous lands, in the Santa Rita Mountains, 35 miles southeast of Tucson. Formation greatly resembles that at Bisbee, the carboniferous limestone strata being of the same geological horizon, with similar porphyritic intrusions, but showing much stronger outcrops and gossans.

The mine made an exceptionally fine showing from a depth of 35′, but ores turned to sulphides on the third level, the base ores averaging under 5% copper. Property has about 25 old shafts, and the two working shafts are known as the Isle Royale, 600′, and the Old Dick, 800′. The mine has 1,940′ of shafts, 15,688′ of tunnels and drifts and 5,200′ of open-cuts. The Old Dick mine has an open-cut showing a large ore body carrying 4% to 6% copper, with small gold and silver values. The Heavy Weight mine shows low grade concentrating ores. The lower levels of the Isle Royale show sulphide ores, much needed for fluxing, which formerly were lacking. Sufficient water for mine and smelter use is furnished by the Isle Royale shaft. Mining plant includes gasoline hoists, also gasoline and steam air-compressors.

The smelter, 2¾ miles from the mines, is connected therewith by a private railway line. The first smelter, built 1899, was burned, 1900, and the present smelter, of 150 tons daily capacity, was blown in, 1901. Largest production was circa 1,000,000 lbs. fine copper, in 1901, after which the mine and smelter were closed down, owing to the exhaustion of the richest oxide and carbonate ores, opened in the upper levels, and the lack of sulphides for fluxing the lower grade oxidized ores. Property was taken under option, 1904, by the Michigan & Arizona Development Co., on terms explained in Vol. V, and was deepened and put on a productive basis by that company, which took pay for its work in stock of the Helvetia Copper Co. Returns from 26,892 tons of ore smelted, 1900–1901, averaged $14.47 per ton. The smelter was again blown in, early in 1906, and in May was making circa 6 tons fine copper daily. The matter of erecting a 500-ton concentrator has been considered, as also has the plan of building a new 300-ton smelter and remodeling the present smelter for a matting furnace. Mine is 16 miles from the Southern Pacific railway, at Vail Station, and a private railway to connect therewith may be constructed. Apparently the Helvetia has the making of a large and profitable mine.

HENRIETTA MINE. **ARIZONA.**

Owned by Braganza Gold Mining Co.

HENSON CREEK LEAD MINES CO. **COLORADO.**

Office: 15 Court St., Boston, Mass. Mine office: Lake City, Hinsdale Co., Colo. C. E. Whiting, president; P. T. Newitt, superintendent. Property includes the Bonanza, Magnolia, and other mines, carrying ores of gold, silver, lead and copper. Has water and electric power and a 50-ton concentrator.

HERCULES CONSOLIDATED MINING CO. **COLORADO.**

Mine office: Silverton, San Juan Co., Colo. Thos. H. Kane, superintendent, at last accounts. Mines cupriferous gold and silver ores, and has a 40-stamp mill.

HERCULES GOLD & COPPER CO. **NORTH CAROLINA.**

Office: 81 Fulton St., New York. Mine office: Cid, Davidson Co., N. C. Wm. A. Anderson, president; H. L. Prentice, vice-president; Robert E. Nuese, secretary; Saml. G. W. Brown, treasurer and general manager. Organized May, 1901, under laws of South Dakota, with capitalization $1,000,000, shares $1 par. Lands, circa 1,000 acres owned in fee, and 1,300 acres held under contract, in Davidson county, including the Emmons mine, opened before the American Civil War. Lands show 3 fissure veins, ranging 18″ to 15′ wide, said to give average assays of 7% copper, 2 oz. to 17 oz. silver and $1.50 to $15 gold per ton, from melaconite, bornite and chalcopyrite, mainly the latter. Is opened by shafts of 90′, 140′, 310′ and 510′, and by tunnels of 100′, 100′, 1,500′ and 2,500′, estimated to show about 65,000 tons of ore blocked out for stoping. Has a 600-h. p. steam and electric plant, including 4 hoists, good for depth of 1,000′ each, a 20-drill Clayton duplex air-compressor and 16 power drills. Buildings include a 30x40′ smithy, 16x24′ compressor house, shafthouses of 40x64′ and 60x80′, and 12 dwellings. Has a 30x60′ concentrator and a smelter with a 150-ton Allis-Chalmers water-jacket furnace. Nearest railway, 14 miles. Has on the dump several thousand tons of ore, extracted in development. Property considered promising, but apparently is idle.

HERCULES MINING CO. **WYOMING.**

Office: 523 Bee Bldg., Omaha, Neb. C. M. Jacques, president and general manager; J. E. Thatcher, secretary and treasurer. Capitalization $1,000,000, shares $1 par. Lands, 4 claims, area 80 acres, showing fissure veins of 9′ average width, giving assay values of 5% to 49% copper, from carbonate and sulphide ores. Has a 90′ tunnel and a 280′ shaft, with steam and gasoline power. Idle since 1903.

MINAS HERCULES y OTRAS. **CHILE.**

Mine office: Taltal, Antofagasta, Chile. Henri Hintze, owner and manager. Mines include the Hercules, Silesia and Inesperada, which are producers of gold and copper ore. Have steam power and 4 Chilean mills, employing about 100 men, at last accounts.

HERKULES FRISCHGLÜCK-STOLLN UND KIESELS HOFFNUNG ERBSTOLLN. **GERMANY.**

Office: care of E. R. Poller, Johanngeorgstadt, Saxony, Germany. Ores are sphalerite and chalcopyrite.

HERMINA MINING CO., LTD. **ONTARIO.**

Office: Fifth St, Calumet, Mich. Mine office: Massey Station, Algoma, Ont. Employs 45 men. Joseph Hermann, president; Wm. H. Greene, vice-president; H. Appleton, secretary; Wm. B. Anderson, treasurer; preceding officers: Paul P. Roehm, Edward L. Ulseth, H. E. Lean and Peter Pritneau, directors; Wm. Daniell, superintendent. Organized 1903, under

laws of Ontario, with capitalization $2,500,000, shares $12.50 par, $8 per share paid in; issued, $1,078,750. Merchants & Miners Bank, Calumet, Mich., registrar.

Lands, 1,240 acres, held on bond and lease, also 300 acres timber lands, in Salter township, Sudbury mining district, showing 3 contact veins, between schist and quartzite, these standing nearly vertically, with dip of about 85° and having an average width of 5′, 7′ and 24′, and being traceable circa 2.5 miles. Veins No. 1 and No. 2, which are undergoing development, are about 1.5 miles apart. Ore is exclusively chalcopyrite, and a careful sampling of No. 3 shaft, by Dr. G. Fernekes, gave 4.3% copper and $2.80 gold per ton Has 3 shafts, No. 1 having a vertical depth of 300′, No. 2 being 210′, and No. 3 also being 210′ in depth. Mine also has a 220′ tunnel. Development has been continuous since begun, 1903.

Equipment includes a 150-h. p. steam plant, with Allis-Chalmers hoists of 50 h. p. and 75 h. p., good for 2,000′ each, a 5-drill Rand air-compressor, 7 power drills, a 22x46′ machine shop, 18x36′ carpenter shop, 18x32′ smithy, engine-house, boiler-house, etc., with a total of 14 frame buildings.

No. 1 shaft, 300′ deep, is the principal opening. A sample shipment of 3 cars of ore gave returns of better than 10% copper, with small gold values. No. 3 shaft, which is on No. 3 vein, shows an ore body of 24′ in width, but lower in grade than the ore in No. 1.

Property is served by the Canadian Pacific railway, 2 miles distant. Fuel is wood, costing $1.25 per cord. Company plans sinking No. 3 shaft to the 400′ level, and beginning production, during 1906. The matter of building a 300-ton smelter, on the north shore of Lake Huron, is under consideration. Management is good and property is considered promising.

HERMIT GOLD & COPPER MINING & SMELTING CO. **ARIZONA.**

Letter returned unclaimed from former office, Salt Lake City, Utah. J. W. Lee, president; Edwin W. Lee, treasurer; F. J. Barber, secretary. Organized 1904, under laws of Utah, with capitalization $100,000, shares 10 cents par. Lands are the Hermit group, in Coconino county, Arizona. Idle.

HERMIT LAKE COPPER CO. **COLORADO.**

Office: 31 Milk St., Boston, Mass. Mine office: Silver Cliff, Custer Co., Colo. John H. Norton, president; Oliver J. Kimball, secretary; W. S. Elmendorf, superintendent. Organized 1899, under laws of Maine, with capitalization $2,000,000, shares $20 par. Ores carry gold and copper. Has water power and a 20-stamp mill.

HERMOSA COPPER CO. **NEW MEXICO.**

Office: 42 Broadway, New York. Mine office: Hanover, Grant Co., N. M. Employs circa 300 men. Anson W. Burchard, president; M. F. Westover, secretary; D. M. Riordan, treasurer and general manager; Henry N. Darling, assistant treasurer; L. B. Judson, assistant secretary. Organized July 20, 1905, under laws of New Jersey, with capitalization $100,000, shares $100 par. Corporation Trust Company, New York, registrar. Annual meeting, first Monday in June.

Lands, 114 claims, area circa 2,200 acres, held partly in fee and partly under option, all in the Central or Hanover district. Lands include the Ivanhoe, Copper Queen, Treasure Vault, Wild Cat, Ninety, Humboldt, Tourmaline, and other mines and attempts at mines. Country rocks are porphyry, granite, quartzite and limestone, showing various contact veins between granite and limestone, with porphyry intrusions, ores occurring as lenticular bodies, in veins, with a generally northeasterly and southwesterly strike, and an average dip of circa 45°. Four different ore bodies are being developed, these ranging 15′ to 20′ in width, with a known depth of 410′ and known length of 2,000. Development is by shafts, as follows: Ivanhoe, 350′; Ninety, 410′; Treasure Vault, 325′; Wild Cat, 410′; Humboldt, 300′; Copper Queen, 200′; Tourmaline, 300′; Mabel, 200′. All shafts show ore, and the various mines have about 14,000′ of underground workings, estimated to show 100,000 tons of ore, with 25,000 tons blocked out for stoping. The property shows large bodies of low-grade concentrating ore, carrying average values of 3% copper, 3 oz. silver and slightly under $1 gold per ton, with small quantities of lead near the surface, and occasional traces of zinc, but not in sufficient quantities to materially hamper reduction.

The mines were discovered circa 1800, and opened 1880, but were worked intermittently, owing to various Indian troubles and lack of funds, until taken over, 1904, by the present owner, which practically is the General Electric Company, one of the strongest corporations of the United States.

Property has a steam plant of 700 h. p., with 7 hoists, good for depth of 500′ to 1,000′, and has bought 3 powerful new hoists for the Ivanhoe, Humboldt and Copper Queen shafts. Equipment includes 4 Sullivan air-compressors, of 26 drills aggregate capacity, with 26 power drills, and buildings include a 20x40′ machine and blacksmith shop, 40x100′ carpenter shop and framing-mill, shafthouses at each shaft, warehouse, bunkhouses, sawmill, etc., with a total of 23 buildings, all of wood.

The concentrator, 40x90′, has a No. 14 Blake crusher, two sets of rolls, one Hartz jig, 5 Overstrom tables, 2 Wilfley tables, 7 screw sizers, one hydraulic sizer and a Huntington mill, rated capacity of the plant being 100 tons daily. Property is served by the Santa Fé railway. Fuel is bituminous coal, costing $5.25 per ton, with a little wood, costing $3.75 per cord. Cost of mining is placed at $2.50 per ton, and concentrating at 50 cents per ton. The property is being developed systematically, on a large scale, and is considered decidedly promising, while the management is excellent.

MINA LAS HERRERIAS. **SPAIN.**

Operated by Bede Metal & Chemical Co., Ltd.

HESPERUS GOLD & COPPER MINES CO. **BRITISH COLUMBIA.**

Office: care of Samuel P. Brannan, secretary, 709-145 La Salle St., Chicago, Ills. Mine office: Grand Forks, Yale district, B. C. Chas. J. Magee, president; T. H. Rae, managing director. Organized 1903, with capitalization $1,000,000, shares $1 par. Property includes the Betts, Hesperus, Lancaster

and Chicago claims, on Hardy Mountain, circa 4 miles from Grand Forks, developed by several hundred feet of crosscuts and shafts, showing promising bodies of self-fluxing sulphide ore. No. 2 tunnel is planned to be driven 600′.

HETTA MOUNTAIN GROUP. **ALASKA.**

Lands, 8 claims, near Copper Harbor, Prince of Wales Island, Alaska, in north latitude 59°. It is asserted that property has a vein 2′ to 20′ wide and 3,000′ long, averaging 10% copper, 3 oz. silver and $2 gold per ton, which is claiming too much.

HETTIE GREEN GROUP. **BRITISH COLUMBIA.**

Office and mine: care of James Thompson, owner, Alberni, Vancouver Island, B. C. Lands, on Tranquil Creek, Bear River district, Clayoquot division, give a fair showing of chalcopyrite, with occasional bornite. Began production on a small scale, 1905, making several small shipments of good ore to the Tyee smelter.

HIBBE GOLD & COPPER MINING CO. **CALIFORNIA.**

Office: Sheridan, Cal. N. H. Kaichner, president; Geo. Grutman, secretary and treasurer. Organized 1903, with capitalization $75,000, to operate in Hibbe county, California. Presumably idle.

HIBIRA MINE. **JAPAN.**

Mine office: Kitakata-mura, Higashi-Usuki-gori, Hyuga, Japan. Is an ancient mine, carrying chalcopyrite associated with iron pyrites, averaging 5% to 6% copper, in lenses lying in clay-slate and sandstone. Production, 1900, was 1,769,498 lbs. fine copper.

J. F. HICKS & CO. **TENNESSEE.**

Mine office: Bristol, Sullivan Co., Tenn. Lands, sundry copper claims, slightly developed. Idle for some years.

HIDALGO MINING CO. **MEXICO.**

Office: care of W. M. Adamson, manager, Douglas, Ariz. Mine office: Nacozari, Sonora, Mex. Employs 20 men. Organized under laws of Arizona, with capitalization $3,500,000, shares $1 par. Lands, 80 pertenencias, area 198 acres, in 3 groups, lying circa 6 miles west of the Moctezuma Copper Co., and 4 miles from the Nacozari railroad. Property shows a vein of 200′ estimated width, carrying a 12′ paystreak giving assays of 15% to 30% copper, opened by a 135′ tunnel and 300′ main shaft, with about 2,000′ of workings. Ores assay also $2.50 to $8 gold per ton, with a little lead. Property has a spring, water from which has given assays of 6.5 grains copper per gallon. Management is good and property is considered promising.

HIDDEN TREASURE GROUP. **CALIFORNIA.**

Office and mine: care of Alger Bros., owners, Callahan, Siskiyou Co., Cal. Lands, 3 claims, on Boulder Creek, 4 miles southwest of Callahan. Has a 100′ tunnel, showing an 8′ vein of disseminated chalcopyrite, with quartz gangue. Presumably idle.

HIDDEN TREASURE GROUP. **MONTANA.**

Office and mine: care of W. J. Stephens, owner, Higgins Blk., Missoula, Missoula Co., Mont. C. A. Russell, superintendent. Employs 4 to 10 men.

Lands, 6 patented claims, in the Wallace district, carrying 3 contact veins, between slate and porphyry, main vein showing 40′ of concentrating ore and a 50″ paystreak of sulphide shipping ore, latter giving smelter returns of 13% copper, 28 oz. silver and $5.50 gold per ton. Management estimates average values at 6% copper, 12 oz. silver and $3.75 gold per ton. Development is by shafts of 58′ and 149′, and by tunnels of 558′ and 1,300′, with about 3,000′ of underground openings, with upwards of 1,000 tons of ore blocked out for stoping. During 1905 shipped 260 tons, averaging about $30 per ton in value, to the East Helena and Tacoma smelters.

HIDDEN TREASURE MINING & MILLING CO. **WASHINGTON.**

Office: 27 Pacific Blk., Seattle, Wash. Mine office: Methow, Okanogan Co., Wash. Joseph West, treasurer and general manager. Organized 1896. Has a fissure vein of 2′ to 4′ average width, with occasional chutes of 8′ to 10′ width, traversing gneiss and carrying auriferous and argentiferous galena, sphalerite and chalcopyrite, with quartz and calcite gangue. Smelter shipment of 90 tons gave returns of $67 per ton. Presumably idle.

HIDDEN TREASURE MINING & TUNNELSITE CO. **WYOMING.**

Office: Lincoln, Neb. Letter returned unclaimed from former mine office, Battle, Carbon Co., Wyo. H. M. Rice, manager. Had auriferous and argentiferous copper ores, opened by tunnel.

HIGASHIYAMA MINE. **JAPAN.**

Mine office: Higashiyama-mura, Oe-gori, Awa, Japan. Ore is chalcopyrite, associated with iron pyrites, occuring in lenses lying in quartz schist, and averaging 2% to 2.5% copper. Production, 1898, was 104,424 lbs. fine copper.

HIGGINS DEVELOPMENT CO. **ARIZONA.**

Dead. Fully described in Vols. IV and V.

HIGGINS GROUP. **ARIZONA.**

Office: care of Thos. Higgins, Los Angeles, Cal. Mine office: Bisbee, Cochise Co., Ariz. Property was under bond formerly to Higgins Development Co., and was fully described, under that title, in Volumes IV and V.

HIGH HILL MINE. **VIRGINIA.**

Owned by Virginia Copper Co., Ltd.

HIGHLAND BOY CONSOLIDATED MINING CO. **UTAH.**

Office: care of Clarence K. McCornick, secretary and treasurer, Salt Lake City, Utah. Mine office: Bingham Canyon, Salt Lake Co., Utah. J. W. Houston, president. Lands, 54 acres, surrounded by the Utah Consolidated, Yampa, Boston Consolidated and other mines. Development is by a 2,600′ tunnel, with about 4,000′ of underground openings. Property regarded as decidedly promising.

HIGHLAND BOY GOLD & COPPER MINING CO. **UTAH.**

Controlled, through stock ownership, by Utah Consolidated Mining Co.

HIGH LONESOME GOLD MINING & MILLING CO. **COLORADO.**

Mine office: Coulter, Grant Co., Colo., Dr. W. E. Rammel, secretary and treasurer; E. S. Reardon, vice-president and superintendent. Organized 1902, with capitalization $500,000. Is claimed to have a 38′ ore body, ex-

posed by open-cut, averaging 18% to 21% copper and one-half oz. gold per ton, which, of course, is somebody's gross exaggeration.

HIGH ORE GOLD & COPPER MINING CO. **MONTANA.**

Letter returned unclaimed from former mine office, Basin, Mont.

HIGH ORE MINE. **MONTANA.**

Owned by Anaconda Copper Mining Co.

HIGH TOP COPPER MINING CO. **VIRGINIA.**

Office: 1552-150 Nassau St., New York. Mine office: Elkton, Rockingham Co., Va. Morris D. Brown, president; Prentice W. Brown, secretary and treasurer; S. D. Brown, general manager. Lands, circa, 1,000 acres, in Greene county, Virginia, 7 miles from the Norfolk & Western railroad, said to show 3 wide fissure veins, carrying carbonate and sulphide ores, latter estimated to contain average values of 6% copper, 10 oz. silver and $15 gold per ton, which is entirely too high. Apparently development is confined to a 140′ shaft and some open-cuts. Has steam power. Presumably idle.

MINA LA HIGUERA. **CHILE.**

A small copper producer in the vicinity of Coquimbo, Chile. Possibly same as Compañía Minera San Juan.

HILETA GOLD & SILVER MINING CO. **MEXICO.**

Mine office: Velardeña, Durango, Mexico. Employs 100 men. Carter Barker, general manager. Lands, 32 pertenencias, area 79 acres, also 63 acres miscellaneous lands, adjoining the Velardeña mines. Country rocks are limestone and porphyry, showing 5 veins, of which one, of 12″ to 3′ width, opened by a 1,600′ tunnel, with about 4,000′ of workings, carries ore averaging about 2% copper, 7% lead, 5% zinc, 60 oz. silver and $4.50 gold per ton. Equipment includes a steam plant, with two hoists, good for 1,000′ each, and a 4-drill air-compressor.

F. C. HILLS & CO. **SPAIN.**

Operators of Compañía del Ferrocaril y Minas del Buitron.

HILLSIDE COPPER MINING CO. **NEVADA.**

Office: 201 Exchange Bldg., Denver, Colo. Mine office: Pioche, Lincoln Co., Nev. Wm. Gelder, president; M. E. Buffington, secretary; J. E. Gelder, treasurer. Organized 1901, under laws of Neveda, with capitalization $2,000,000, shares $1 par. Lands, sundry mining claims, in the Bristol district, 50 miles from a railroad, including mines that formerly paid considerable dividends from silver-lead ores, which at depth changed to silver-copper ores. A small test shipment gave smelter returns of 12% copper and 12 oz. silver per ton. Is closely connected, in ownership and management, with the Bristol Copper Mining Co. Property considered promising, if given rail connections, but at last accounts was idle, and owed circa $30,000 to its promoters.

HIMALAYA MINING CORPORATION, LTD. **INDIA.**

Dissolved, January, 1905.

HIMMELFAHRT FUNDGRUBE. **GERMANY.**

Office: care of Kgl. Sächs. Staatsfiskus, Dresden, Germany. Mine office: Freiberg, Saxony, Germany. Employs circa 1,100 men. K. Ste-

phan, manager. Is owned and operated by the Saxon Crown. Ores carry silver, lead and copper, production of latter being very small.

HIRAKANE MINES. **JAPAN.**

Mine office: Nibukawa, Rikuchu, Japan. T. Yokoyama, owner; S. Tsubouchi, superintendent. Ores carry silver and copper. Mines have steam and electric power, and a smelter, employing several hundred men.

HISAMUNE MINE. **JAPAN.**

Mine office: Kawada-mura, Oe-gori, Awa, Japan. Is a comparatively new property. Ore, which is chalcopyrite, slightly argentiferous, and averaging 4% copper, occurs imbedded in clay-amphibolite, beds ranging 2′ to 5′ in thickness. Production, 1899, was 112,196 lbs. fine copper.

HISANICHI MINE. **JAPAN.**

Mine office: Nakagawa-mura, Senhoku-gori, Ugo, Japan. Ore is chalcopyrite, associated with sphalerite and iron pyrites, all slightly argentiferous, in a vein in augite-andesite. Production, 1900, was 134,074 momme silver and 566,268 lbs. fine copper.

HODGES HILL MINE. **NORTH CAROLINA.**

An old and idle property in Guilford county, North Carolina. Ore is chalcopyrite, with quartz gangue, in a vein of 6′ to 12′ width.

HOFMAN CLAIMS. **CALIFORNIA.**

Four claims, area 80 acres, near Ukiah, Lake county, California, giving assays of 6% copper, $5 gold and 2 oz. silver per ton, from carbonate and sulphide ores. Idle.

HOFRET EL NAHAS MINES. **SUDAN.**

In Southwest Kordofan, Anglo-Egyptian Sudan. Are worked in a small way, to meet purely local demands, ore being smelted in a primitive manner, at the mines.

HOGASHO MINE. **JAPAN.**

Mine office: Hatayama-mura, Aki-gori, Tosa, Japan. Ore is chalcopyrite, associated with iron pyrites, averaging about 7% copper, and occurs in lenses in country rocks of shale and sandstone, with intercalated red and green schalkstein. Production, 1900, was 138,032 lbs. fine copper.

GEWERKSCHAFT HOHENSTAUFEN. **GERMANY.**

Mine office: Essen, Rheinprovinz, Germany. W. Brandenburg, president. Mine produces yearly circa 3,000 metric tons of zinc and copper ores, zinc values predominating.

HOKOISHI MINE. **JAPAN.**

Mine office: Kamo-mura, Nii-gori, Iyo, Japan. Ore is chalcopyrite, associated with pyrite, averaging 3.5% to 4% in copper tenor, occuring in narrow veins of 12″ average width, traversing chlorite-amphibolite. Production, 1900, was 52,373 lbs. fine copper.

HOLDEN EXTENSION GOLD & COPPER MINING CO. **WASHINGTON.**

Mine office: Chelan, Chelan Co., Wash. W. J. Bowen, secretary and general manager. Capitalization, $1,500,000. Lands, 2 claims. Idle.

HOLDEN GOLD & COPPER CO. **WASHINGTON.**

Mine office: Chelan, Chelan Co., Wash. J. H. Holden, president. Lands,

3 claims, area 60 acres, on Railroad Creek, near Lake Chelan, opened by 3 tunnels, longest 500′, showing a vein of 40′ to 54′ width, carrying low-grade auriferous copper ores. Property needs cash for extensive development, and a railroad for transportation. Given these essentials, it might be made a valuable mine.

HOLLAND GOLD & COPPER MINING CO. **BRITISH COLUMBIA.**

Mine office: Princeton, Similkameen district, B. C. James E. McCauley, president. Lands. sundry claims, on the western slope of Copper Mountain, near the Similkameen river. Company planned resuming work in spring of 1906.

HOLLAND MINE. **ARIZONA.**

Mine office: Washington, Santa Cruz Co., Ariz. G. W. Crowe, superintendent. Mine is opened by shaft and tunnel, showing auriferous and argentiferous chalcopyrite, sphalerite and galena. Has steam power and a small concentrator.

HOLLOWAY MINE. **VIRGINIA.**

Office: care of Alfred S. Wright, owner, 48 South Third St., Philadelphia, Pa. Mine office: Virgilina, Halifax Co., Va. Property is the old Holloway or Eustis mine, 6 miles north of Virgilina, first worked previous to the American Civil War. Ores are sulphide, mainly chalcopyrite, carrying small gold and silver values. Mine shipped considerable ore to smelters at Norfolk, Va., circa 1900-1903. Present owner plans continuing development.

HOLMES MINING & MILLING CO. **WISCONSIN.**

Office and mine: Mellen, Ashland Co., Wis. C. A. Poundstone, president; John Holmes, vice-president; A. W. Peterson, secretary and general manager. Organized 1902, under laws of Wisconsin, with capitalization $150,000, shares 25c. par. Lands, 80 acres, in the Penokee district, showing three veins carrying native copper, also sulphide copper ore assaying 30 oz. silver and $3.70 gold per ton, opened by a 140′ shaft. Idle.

HOME COPPER CO. **ARIZONA.**

Office and mine: Morenci, Graham Co., Ariz. Dr. A. M. Tuthill, president; R. H. Waugh, secretary and treasurer N. L. Jenkins, superintendent. Organized April, 1901. Lands, 35 claims, area circa 700 acres, in 2 groups, also a millsite on Eagle river. The Peacock group of 23 copper claims, about 1 mile southwest of Morenci, is opened by an 85′ shaft and tunnels of 150′ and 700′, latter giving a 500′ back. Ores are carbonates and oxides, with some chalcocite, also a wide ledge of low-grade ore that is too lean for present working. The Buzzard Shadow group of 12 claims, across Gold Gulch, about 1 mile north of the Peacock group, shows a wide quartz vein carrying gold ore worth up to $50 per ton, slightly developed by tunnel and shaft. Is developing steadily.

HOME COPPER CO. **WASHINGTON.**

Mine office: Cle-Elum, Kittitas Co., Wash.

HOME COPPER MINING CO. **MICHIGAN.**

Lands, 240 acres, adjoining the Humboldt mine, in Keweenaw county, Michigan. Never a producer.

HOME COPPER MINING CO. **MONTANA.**

Disincorporated, 1903, with all debts paid.

HOME GOLD & COPPER CO. **NEW MEXICO.**

Dead, and lands passed to other hands.

HOME GOLD & COPPER CO., LTD. **ONTARIO.**

Letter returned unclaimed from former office, 90 Canada Life Bldg., Toronto, Ont. Fully described and identified, by genus and species, in Volumes IV and V. Stock was peddled by one Rufus L. Herrick, who opened his office with prayer.

HOME RUN COPPER MINING CO. **WYOMING.**

Office: 34 Giddings Bldg., Colorado Springs, Colo. Letter returned unclaimed from former mine office, Rudefeha, Carbon Co., Wyo. Capitalization $1,500,000, shares $1 par. Lands, 180 acres, 60 acres patented, near the Ferris-Haggarty mine of the Penn-Wyoming. Company claims to have no debts, but furnishes no returns, and its advertising is not regarded with favor.

HOMESTAKE MINE. **ARIZONA.**

Mine office: Gilbert, Yavapai Co., Ariz. Ores carry gold and copper. Has gasoline power. Presumably idle.

HOMESTAKE MINES, LTD. **BRITISH COLUMBIA.**

Mine office: Rossland, Yale district, B. C. Geo. H. Bayne, manager. Ores carry gold, silver and copper. Has steam power. Presumably idle.

HOMESTAKE MINING CO. **ARIZONA.**

Letters returned unclaimed from former office, Chicago, Ills., and former mine office, Jerome, Yavapai Co., Ariz. Apparently a petty swindle.

HONERINE MINE. **UTAH.**

Mine office: Stockton, Tooele Co.. Utah. E. J. Raddatz, superintendent. Property is extensively developed and has a drainage and transport tunnel, on the 1,300′ level, now 8,000′ long, and to be 9,000′ eventually. Mine is opened to depth of 1,000′, and makes about 7,000 gallons of water per minute, hence the drainage tunnel will afford great relief. Property is primarily a silver-lead mine, but produces considerable copper. Ore produced is of two grades, the shipping ore averaging about 50% lead, 3% copper, 30 oz. silver and $1.50 gold per ton, while the concentrating ore averages 15% lead, 1% copper, 12 oz. silver and 80 cents gold per ton. The milling ore is concentrated 3.5 into one.

HOOSIER COPPER MINING & MILLING CO. **WYOMING.**

Office: Shelbyville, Ind. Letter returned unclaimed from former mine office, Encampment, Carbon Co., Wyo. Capitalization $1,500,000, shares $1 par. Lands, 9 claims, area 180 acres, developed by a shallow shaft, said to give a fair showing of medium-grade ore. Idle.

HOP CANYON MINING & SMELTING CO. **NEW MEXICO.**

Office: 85-163 Randolph St., Chicago, Ills. Mine office: Magdalena, Socorro Co., N. M. Alpheus McCallum, president; Elias G. Raffety, secretary and treasurer. Capitalization $1,000,000, shares $1 par. Lands, 6 claims, area 120 acres, 3 miles from a railroad, in the Hop Cañon district, showing ores carrying copper, lead, zinc, silver and gold.

HORN GROUP. **CALIFORNIA.**

Office and mine: care of H. M. Horn, manager, Needles, San Bernardino Co., Cal. Lands, sundry claims at the base of Turtle Mountain.

HORN SILVER MINING CO. **UTAH.**

Office: 17 Battery Place, New York. Mine office: Frisco, Beaver Co., Utah. Allen C. Washington, president; Juan M. Ceballos, vice-president; Ambrose J. Harrison, secretary and treasurer; Philo T. Farnsworth, manager. Organized 1879, under laws of Utah, with capitalization $10,000,000, shares $25 par. Mine is extensively developed and is a considerable producer of zinc, lead, silver and gold, and securesa little copper as a by-product. The Old Bonanza mine shows good values at a depth of 800′, carrying silver ores on the footwall, with a little copper on the hanging-wall. Equipment includes a 30-stamp mill. Production 1905, was 6,035,553 lbs. zinc, 3,464,007 lbs. lead, 6,539 lbs. copper, 104,231 oz. silver and 335 oz. gold, Copper production, 1902, was 717,353 lbs., showing a great decrease in three years. Net earnings 1905, were $135,770, from which dividends of $80,000 were paid. Property is an old producer, with a large dividend record, but is gradually declining in production and profits.

HORSE SHOE COPPER MINING CO. **ARIZONA.**

Dead. Former office, Park Row Bldg., New York. Lands, near Safford, Graham county, Arizona, have passed to another corporation. Ignatius L. Qualey, the president, Frank S. Weller, the secretary, Chas. Carbonelle, the treasurer, "Baker Tom" Putnam and "Larry" Summerfield, alias Fred Herbert, all were sentenced to the penitentiary, for swindles connected with sales of stock of this company, their frauds being of a flagrant nature.

HORSESHOE GOLD MINING CO. **COLORADO.**

Mine office: Central City, Gilpin Co., Colo. N. H. Scheur, superintendent. Property is the Barnes mine, carrying gold, silver and copper ores. Has steam power.

HORSFAL MINING CO. **COLORADO.**

Mine office: Gold Hill, Boulder Co., Colo. D. Wiggers, superintendent. Ores carry gold, silver and copper. Has steam power.

HOUGHTON-ALASKA EXPLORATION CO. **ALASKA.**

Office: Houghton, Mich. Prof. Arthur E. Seaman, consulting engineer. Organized circa 1905, under laws of Michigan, with capitalization $500,000. Lands, sundry claims in Alaska.

HOUGHTON DEVELOPMENT CO. **ARIZONA.**

Dead. Fully described in Vols. IV and V.

HOULIHAN GOLD & COPPER MINING CO. **ARIZONA.**

Mine office: Jerome Junction, Yavapai Co., Ariz. J. T. Whedon, president; Geo. Houlihan, vice-president; Geo. C. West, secretary and treasurer. Has a 100′ shaft, said to cut a 35′ vein. Idle.

HOWARD COPPER CO. **MONTANA.**

Letter returned unclaimed from former office, 618 Broadway, New York. Mine office: Phillipsburg, Granite Co., Mont. Lyman N. Loomis, of Butte, Montana, president and treasurer. Organized under laws of South

Dakota, with capitalization $1,500,000, shares $1 par. Title to lands, which were 60 acres, slightly developed, supposed to have been lost. President is said to be an honest man, but company was promoted by Ralph M. Jacoby.

HOWARD COPPER CO.

Office: 451 Equitable Bldg., Baltimore, Md.

HOWARD MINING CO. **VIRGINIA.**

Mine office: Virgilina, Halifax Co., Va. C. N. Howard, general manager. Lands include the Chappel mine, 10 miles from Virgilina, adjoining the High Hill mine of the Virgilina Copper Co., on the northeast, also a gold property, about 4½ miles north of Virgilina. Presumably idle.

HOWE SOUND MINING CO. **BRITISH COLUMBIA.**

Office: care of Geo. H. Robinson, Vancouver, B. C. Organized under laws of Maine, with capitalization $2,000,000, shares $500 par. Said to have been formed to take over the Britannia mine, on Howe Sound, British Columbia.

HOWELL MINES. **AUSTRALIA.**

Mine office: Howell, N. S. W., Australia. John Howell, manager. Property includes the Conrad mine, with a 250′ main shaft, showing an ore body assaying 3% copper and 2 dwts. gold, with fair tin values.

HOWLE COPPER MINES. **ARIZONA.**

Letter returned unclaimed from former mine office, Globe, Ariz.

HUACHUCA CONSOLIDATED DEVELOPMENT CO. **ARIZONA.**

Office: Bisbee, Ariz. Mine office: Palmerlee, Cochise Co. Ariz. J. S. Palmerlee, president and general manager; Jas. G. Cowen, secretary; S. W. Clawson, treasurer; preceding officers, H. T. Hosking, L. G. Jackson, A. A. Brockway and J. T. Hood, directors. Capitalization $1,250,000, shares $5 par. Lands, 24 claims, area 480 acres, in the Huachuca Mountains, circa 25 miles west of Bisbee, opened by 2 tunnels and a 200′ shaft, showing 8 parallel fissure veins of 3′ to 28′ width, carrying ore, with quartz gangue, assaying 3% copper, and up to $28 gold per ton. Out of funds and idle, at last accounts.

FUNDICIÓN HUACRACOCHA. **PERÚ.**

Office: care of Dr. Valentine, Lima, Perú. Works office: Morrococha, Peru. Works are 3 miles from Morrococha, on the shore of Lake Huacracocha, with railroad connections, and include a small concentrator, and smelter having a 30-ton water-jacket blast-furnace. Plant runs, irregularly, on ores of the district.

COMPAÑIA HUANCHACA DE BOLIVIA. **BOLIVIA.**

Offices: 29, Rue de Londres, Paris, France. Mine office: Pulacayo, Potosí, Bolivia. E. Senechal de la Grange, president Bolivian board; Marquis J. de Gabriac, chairman French board; Don Luis M. Solá, general manager; Baron J. de Cotelin, consulting engineer; Segundo R. Nava, general secretary, Valparaiso, Chile; Jorge Lewis, agent, Antofagasta, Chile. Organized 1873, and reconstructed 1891, under laws of Bolivia, with capitalization increased, 1877 and 1891, to 40,000,000 francs, shares 125f. par. Largest dividend was 35f., 1891; dividend, 1903, was 2.5f.

Property is silver and copper mines, former more important. The silver mines, area 3,300 acres, at Pulacayo, are large producers. The company also owns smelters at Huanchaca and Playa Blanca, latter leased to the American Smelting & Refining Co., under option of purchase, expiring Oct. 30, 1907. Company has 600 miles of private telephone line, and operates the Antofagasta & Bolivia Railway, under lease.

HUBBARD-ELLIOTT COPPER MINES **ALASKA.**

DEVELOPMENT CO. OF ALASKA.

Office: 1115 Stock Exchange, Chicago, Ills. Western office: 411 New York Blk., Seattle, Wash. Employs 30 men. H. Curtis Elliott, president; Chas. G. Hubbard, vice-president and general manager; A. J. Elliott, secretary; John T. Evans, treasurer. Organized January, 1904, under laws of Washington, with capitalization $1,500,000, shares $1 par. Lands, 120 claims, area 2,400 acres, in the Copper River district, circa 150 miles from Valdez, Alaska, supposedly held under bond and lease. Country rock is greenstone, showing 26 fissure veins, said by management to average 20′ to 65′ width, 300′ to 1,000′ length and 1,100′ depth. A considerable amount of diamond drilling has been done, and development is by the Elizabeth shaft of 192′, and by the Elizabeth tunnel of 160′, with circa 500′ of underground openings, estimated by company to show 600,000 tons of ore, with 400,000 tons available for stoping, which necessarily is an over-estimate. The property shows high-grade ores, said by management to have been proven unaltered to a depth of 200′. Ores are oxides, carbonates and chalcocite, estimated by management to average 27% in copper tenor. Improvements consist of a smithy, carpenter shop and 4 cabins of logs.

HUDSON MINE. **COLORADO.**

Mine office: Granite, Chaffee Co., Colo. W. H. Ball, superintendent, at last accounts. Ores carry gold, silver and copper.

COMPAGNIE DES MINES DE CUIVRE DE HUELVA. **SPAIN.**

Office: Brussels, Belgium. Mine office: La Granada, Huelva, Spain. Don Pedro Melo y Novo, manager. Organized 1900, under laws of Belgium, with capitalization 1,000,000 francs. Property is the Numancia, Sagunto and Taoro mines, carrying cupriferous iron pyrites. Idle for several years.

HUELVA CENTRAL COPPER MINING CO., LTD. **SPAIN.**

Succeeded, 1903, by Huelva Copper & Sulphur Mines, Ltd.

HUELVA COPPER & SULPHUR MINES, LTD. **SPAIN.**

Offices: 75, Constantine Road, London, N. W., Eng., and 17, Blvd. Haussmann, Paris, France. Mine office: Almonáster, Huelva, Spain. P. Bouvard, chairman; C. Blanchard, managing director; G. D. Collas, secretary; A. Ladouce, assistant secretary. Organized Oct. 28, 1903, to take over property of the Huelva Central Copper Mining Co., Ltd., with capitalization £400,000, shares £1 par; issued, £340,457. Lands, 923 hectareas, including the Monte Remero and Cueva de la Mora groups. Has leased 27 hectareas to the Tharsis Sulphur & Copper Co., Ltd., on royalty. Lands, which lie between the Rio Tinto and Tharsis mines, are considered valuable.

HUERFANO GOLD & COPPER MINING CO. **COLORADO.**

Organized 1902, under laws of Kentucky, to develop prospects near Ojo, in the Sierra Blanca district of Huerfano county, Colorado. Idle.

HUESCA COPPER, IRON & LEAD MINES, LTD. **SPAIN.**

Offices: 49, Queen Victoria St., London, E. C., Eng. S. D. Cropper, secretary. Capitalization, £50,000. Apparently moribund.

HUINAC COPPER MINES, LTD. **PERÚ.**

Offices: Leadenhall House, London, E. C., Eng. E. Learoyd, secretary; A. L. Pearse, consulting engineer. Organized May 9, 1904, with capitalization £400,000, shares £1 par; issued, £339,878. Lands, 256 hectareas, in the province of Ancash, Perú. Is said to have secured considerable mining development, and to be building a smelter.

COMPAÑIA MINERA DE HUIRIÁCHIC. **MEXICO.**

Mine office: Chalchihuites, Zacatecas, Mexico. John Stenner, president; C. A. Phelps, treasurer and general manager. Ores are argentiferous and auriferous chalcopyrite and galena, developed by shaft and tunnel.

HULBERT MINING CO. **MICHIGAN.**

Office: 199 Washington St., Boston, Mass. Mine office: Houghton, Houghton Co., Mich. Albert S. Bigelow, president; W. A. S. Chrimes, secretary; Wm. J. Ladd, treasurer; Norman W. Haire, general manager. Lands, 1,598 acres, in Town 57 North, Range 37 West; Town 56 North, Range 33 West, and Town 55 North, Range 34 West, Houghton county, Michigan. Lands are mainly undeveloped properties, and a considerable portion of the surface rights has been sold, mineral rights having been reserved by the company.

HUMBER CONSOLIDATED MINING & MANUFACTURING CO. **NEWFOUNDLAND.**

Office: 27 William St., New York. Letter returned unclaimed from former mine office, York Harbour, Nfld. W. L. Holt, president; J. R. Williams, vice-president; E. W. Faucette, secretary and treasurer; C. E. Willis, managing director; H. V. Smythe, superintendent; S. J. Goodney, mining captain; Corporation Trust Co., New York, registrar and transfer agent. Organized Sept. 23, 1902, under laws of New Jersey, with capitalization $1,200,000, shares $100 par, in 2,000 shares of 8% preferred and 10,000 shares of common stock. Company apparently has gone out of business, to all practical intents and purposes. Fully described in Vol. V.

HUMBOLDT COPPER CO. **NEVADA.**

Office: 609 Kohl Bldg., San Francisco, Cal. E. J. Miley, president; C. C. Darling, Jr., vice-president; M. P. Danly, secretary; preceding officers, E. B. Grace and Dr. Geo. E. Ebright, directors. Organized under laws of Arizona, with capitalization $1,000,000, shares $1 par. Lands, 8 claims, on Jackson Mountain, Humboldt county, Nevada, connected by good wagon road, with a railroad 60 miles distant. Property has circa 1,400′ of workings, showing a vein of 12′ width at surface, widening to 74′ in the lower tunnel, carrying ores that have assayed 15% to 16% copper, 3 oz. to 5 oz. silver and $1.65 gold per ton.

HUMBOLDT COPPER MINING CO. **MICHIGAN.**

Office: 64–50 State St., Boston, Mass. C. Howard Weston, president; John Brooks, secretary and treasurer; J. Wesley Clark, superintendent; preceding officers, W. C. Fisk and Ashley Watson, directors. Organized 1863, under laws of Michigan, with capitalization $1,000,000, shares $25 par. Annual meeting, fourth Tuesday in March. Lands are about midway between the Arnold and Phœnix mines, in Keweenaw county, Michigan. Has one shaft, of 300′, on the Arnold ashbed. Was opened 1853, and last exploratory work was done in 1901. About $125,000 has been expended on the property, which never was a producer.

HUMBOLDT MINE. **NEW MEXICO.**

Office and mine: care of Schlosser & La France, owners, Fierro, Grant Co., N. M. Presumably idle.

HUMBUG MINING CO. **UTAH.**

Mine office: Eureka, Juab Co., Utah. J. W. Roundy, superintendent, at last accounts. Ores carry gold, silver and copper. Has steam power.

HUNGARIAN COPPER CO. **MICHIGAN.**

Wound up, circa 1898. Lands now owned by Oneco Copper Mining Co.

HUNTERS CREEK MINING & MILLING CO. **WASHINGTON.**

Letter returned unclaimed from former office, 701 Phœnix Bldg., Minneapolis, Minn. Geo. W. Smith, president; M. L. Brain, secretary; Manson Rexford, treasurer. Lands, 20 claims, in Stevens county, Washington, said to show a vein of 18″ to 40″ width, assaying 17% to 20% copper. Company claims to have a 755′ tunnel. Secretary Brain writes that a great injustice was done by the statement in Vol V that the company was alleged by shareholders to be a fraud. The annual report of the company is a curiosity, including the most remarkable financial statement ever seen by the Copper Handbook.

HUNT MINING & MILLING CO. **IDAHO.**

Office: 8 India St., Boston Mass. Mine office: Weiser, Washington Co., Idaho. Idle for several years.

HURON GOLD CO. **ARIZONA.**

Office and mine: Jerome, Yavapai Co., Ariz. Geo. W. Hull, president, treasurer and general manager; H. E. Wilcox, secretary. Organized under laws of Arizona, with capitalization $1,000,000, shares $1 par. Lands, 5 claims, area 80 acres, in the Big Bug district, showing a vein of 8′ to 50′ width, opened by a 125′ shaft and a 680′ tunnel, showing ore giving assays of 2.5% to 11% copper and $5 to $30 gold per ton. Idle.

HURON MINING CO. **WASHINGTON.**

Office: Everett, Wash. Mine office: Darrington, Snohomish Co., Wash. Ores carry copper and gold values. Has water power. Presumably idle.

HURONIAN COMPANY. **ONTARIO.**

A subsidiary corporation of the Canadian Copper Co.

HUSSLEMAN & SHAW GROUP. **CALIFORNIA.**

A group of 31 claims, in the Moonlight Creek district, Lights Cañon, Plumas county, California, slightly developed by tunnel.

HUSTON MINE. **ONTARIO.**

Office: care of John J. Case, Cerro de Pasco, Junin, Perú. Lands 1,400 acres, at Montgomery, 15 miles north of Thessalon, Algoma, Ontario. Vein, traced circa 3,000, is 60′ between walls, with an 18′ paystreak, assaying up to 8%. Vein stands up as a 40′ bluff, and best can be developed by tunnels. Ore has a quartz gangue, and could be concentrated to 20% copper, or better. Property lacks rail transportation, and is undeveloped.

HYCO MINE. **VIRGINIA.**

An idle property, near Virgilina, Virginia. Fully described in Vol. II.

HYPOCKA MINING CO. **MONTANA.**

Out of business. Lands sold, 1906, to Butte Coalition Mining Co.

SOCIEDAD COLECTIVA IBARRA HERMANOS. **SPAIN.**

Offices: Sevilla, Spain. Mine office: Cortegana, Huelva, Spain. Don José Luis Buiza, manager. Property is the San Telmo group of 29 old mines, area 222 hectareas, carrying cupriferous iron pyrites. Was undergoing development, at last accounts.

ICONOCLAST CONSOLIDATED MINES CO. **WASHINGTON.**

Office: 412 Berlin Bldg., Tacoma, Wash. Mine office: Keller, Ferry Co., Wash. J. R. Turner, president; C. E. Peterson, secretary. Organized 1902, under the laws of Washington, with capitalization $2,500,000, shares $1 par, as a consolidation of the Alliance Copper Mining Co. and the Iconoclast Gold & Copper Mining Co. Lands, 7 claims, area 115 acres, showing 3 contact veins, one claimed by company to be 150′ wide and to assay 5% copper 2 oz. silver and $5 gold per ton, from chalcopyrite. Development is by a 325′ main shaft, and 3 tunnels, with aggregate length of 514′. Has gasoline power. Presumably idle.

ICONOCLAST GOLD & COPPER MINING CO. **WASHINGTON.**

Absorbed, 1902, by Iconoclast Consolidated Mines Co.

IDAHO CONSOLIDATED COPPER CO. **IDAHO.**

Mine office: Grangeville, Idaho Co., Idaho. Has a 700′ tunnel, and is said to plan installation of electric power and a 100-ton reduction plant.

IDAHO CONSOLIDATED COPPER MINES CO. **IDAHO.**

Dead. Was a mere stock-jobbing scheme.

IDAHO COPPER MINING & SMELTING CO. **IDAHO.**

Office: 502 Andrus Bldg., Minneapolis, Minn. Operating office: care of Chas. G. Carruthers, general manager, Colville, Wash. Lands, 160 acres, on the Salmon river, in Idaho county, Idaho. Assays of surface ore are claimed to give 30% to 40% copper. Idle for several years.

IDAHO MILLING CO. **IDAHO.**

Letter returned unclaimed from former mine office, Doniphan, Idaho.

IDAHO MINES CO. **IDAHO.**

Supposed to have been organized, 1904, by residents of Omaha, Nebraska, to develop copper claims in the Seven Devils district of Idaho.

IDAHO REDUCTION CO. **IDAHO.**

Office: Corcoran Bldg., Washington, D. C. Letter returned unclaimed from former mine office, Weiser, Washington Co., Idaho. Geo. A. Rahm,

president; C. F. Drake, vice-president; F. S. Bright, secretary; John Sennett, treasurer; preceding officers and S. Fairfield, directors. Organized 1903, with capitalization $1,000,000, shares $1 par. Said to plan a smelter, to use a new reduction process.

IDEAL MINING & DEVELOPMENT CO. **ARIZONA.**

Office: 38 Wall St., New York. Mine office: McCabe, Yavapai Co., Ariz. Employs 80 men. Cecil G. Fennell, general manager; M. J. Enright, superintendent Gladstone mine; Jas. O'Brien, superintendent Model mine.

The Gladstone mine, opened by a 900′ shaft, to be deepened, has auriferous and argentiferous copper and lead ores. Equipment includes an electric pump, on the 800′ level, handling 20,000 gallons of water daily, a 120-h. p. Hendrie & Bolthoff hoist, capable of raising 3-ton loads from 1,500′, and a 4-drill Ingersoll-Sergeant air-compressor, all electrically operated by a Crocker-Wheeler motor. The Gladstone, which is considered a valuable property, ships high grade ore to the Humboldt smelter, and runs concentrating ore through the McCabe mill.

The Model mine, 6 claims, formerly known as the McCabe mine, was bought, circa 1906, for $81,521. Development is by a 750′ incline shaft, with about 12,000′ of underground workings, showing several ore bodies carrying 8″ to 10″ of smelting ore, and 12″ to 24″ of milling ore, former carrying combined gold, silver and copper values of $35 to $85 per ton, and latter carrying about 2% copper, with small gold and silver values. Country rock is granite, with numerous intrusive porphyry dikes, the granite being much shattered. The water-level is found at depth of 40′ only, below which the ore is an iron-sulphide, carrying small percentages of auriferous and argentiferous copper, lead and zinc.

The McCabe, or Model mill, has 10 stamps, a 50-ton Elspass mill, 1 Wilfley and 3 Standard tables.

IKONOMOFF CESSION. **BULGARIA.**

Office: care of M. Dimitri Ikonomoff, owner, Hotel Boulevard, Sofia, Bulgaria. Mine office: Kara-Bair, Bourgos, Bulgaria. Property, in the development stage, is held as a cession from the principality. Presumably idle.

IKUNO MINES. **JAPAN.**

Owned by Mitsu Bishi Gosshi Kwaisha.

ILION MINING CO. **UTAH.**

Mine office: Bingham Canyon, Salt Lake Co., Utah. Property supposedly is under bond to W. F. Snyder.

ILLINOIS COPPER MINING CO. **WYOMING.**

Office: 862 Monadnock Blk., Chicago, Ills. Mine office: Encampment, Carbon Co., Wyo. Geo. H. Miller, president and general manager; N. V. S. Mallory, secretary and treasurer; Thos. R. Smith, superintendent. Organized 1899, under laws of Wyoming, with capitalization $1,000,000 shares $1 par. Lands, 9 claims, area 185 acres, in the Upper Platte district, showing 3 contact veins, principal said to be 18′ wide, 50′ deep and 4,500′ long, carrying chalcocite, with quartz gangue, assaying 14% to 27% copper, 20 oz. silver and $4 gold per ton. Has 3 shafts, deepest 70′. Idle.

ILLINOIS GOLD & COPPER MINING CO. **MEXICO.**

Letter returned unclaimed from former mine office, Panuco, Coahuila, Mexico. Property was Los Caballos mine, carrying gold-silver-copper ores.

IMA CONSOLIDATED MINING & MILLING CO. **IDAHO.**

Letter returned unclaimed from former mine office, Patterson, Lemhi Co., Idaho. Ores carry silver, gold and copper. Had steam power and a 100-ton concentrator.

IMPERIAL COPPER CO. **ARIZONA.**

Office: 11 Pine St., New York. Operating office: Tombstone, Ariz. Mine office: Silver Bell, Pima Co., Ariz. Employs 300 men. E. B. Gage, president; W. F. Staunton, vice-president and general manager; A. N. Gage, secretary and treasurer; preceding officers, Selwyn Eddy, F. M. Murphy, V. L. Mason and H. M. Robinson, directors; David Morgan, mine superintendent; C. C. Klingerman, railroad superintendent; S. F. Shaw, engineer; C. M. Dietz, auditor.

Organized May 15, 1903, under laws of Arizona, with capitalization $5,000,000, shares $10 par. Bonds, $2,000,000 authorized, $1,282,400 issued, at 6%. Ended 1905 with cash on hand, $50,746.65, with $84,155.06 due the company. First dividend, paid April 15, 1906, was $100,000. Annual meeting, second Thursday in April.

Lands, 60 claims, mostly patented, area circa 1,000 acres, also a 640-acre millsite, at Redrock, with total holdings of circa 3,000 acres, in the Silver Bell district. Property includes the Old Boot mine, now known as the Mammoth, opened circa 1865, which was a limited producer of high-grade copper and silver-lead ores, at irregular intervals, before bought by present company. Property is in the Silver Bell Mountains, a small independent range, at an elevation of 2,900′ above sea-level. These mountains have granitic bases, with limestone and quartzite cappings, latter much eroded and entirely gone at many points. There has been much faulting and shearing, ore bodies occuring as irregular lenses, with axes parallel to fault and fissure planes, and having a northwesterly strike. The granite-porphyry in the vicinity of the lenses, which occur mainly at the lime-porphyry contacts, is strongly mineralized with copper sulphides. Eruptive dikes of diorite are highly altered, and the ore bodies have strong gossan cappings. The geology of the Silver Bell Mountains is typical of some of the best Arizona copper fields, and is of a highly promising nature. The oxidized zone is comparatively shallow, not extending below 150′ from surface, in the principal workings, which show a sharp change from the oxidized to the unaltered zone. The upper ores are mainly cuprite, malachite and azurite, which have furnished the bulk of past production, while the ores below the water-level are mainly chalcopyrite, with occasional bornite. The mines also show some cupriferous silver-lead ore, much of which is an intimate mixture of galena, sphalerite and chalcopyrite, decidedly difficult of satisfactory reduction. Ores mined average 9.08% copper, 1.2 oz. silver and 12 cents gold per ton.

The mine is opened by the Page crosscut tunnel, length 1,200′, and by the Mammoth shaft, 500′, and the Union shaft, 350′, with a total of about 5

miles of underground openings, showing large quantities of ore. The Old Boot mine, now called the Mammoth, was opened to a vertical depth of about 400′ by an incline shaft, which has been replaced by the 500′ two-compartment Mammoth vertical shaft, the old shaft being used solely for ventilation and pump-columns. The Union shaft also has two compartments.

The mine has a 450-h. p. steam plant, with 5 hoists, of 12 h. p. 200 h. p. each, largest good for 1,000′ depth. Equipment includes 2 two-stage Norwalk air-compressors, of 10-drill capacity each, and 15 power drills. Buildings include 20x30′ and 30x80′ machine shops, of wood, sheathed with corrugated iron, a 36x40′ carpenter shop, 18x50′ smithy, store, bunk-houses, boarding-houses, changing-houses, and 20 dwellings. The property includes an old 100-ton matting furnace, 1¼ miles from the mine, which probably will not be used at all, unless rebuilt, modernized and greatly enlarged, and a 10-ton experimental mill, 20x40′, having 1 Gates crusher, 1 set of rolls, 2 Hartz jigs, 1 Wilfley table, 1 vanner, 1 sizer and 1 sampler. In order to secure rail connection with the Southern Pacific, the Imperial company built the standard-gauge Arizona Southern Railway, 21 miles in length, from Silver Bell to Redrock, equipped with 2 locomotives and 5 cars.

Production, 1904, was 3,030,632 lbs. fine copper, and for 1905 was 5,687,152 lbs., and should reach circa 7,000,000 lbs. in 1906. Plans are being made for a reduction plant, to be located at Redrock, and it is hoped to begin the work of actual construction during 1906. The plant will include both concentrator and smelter, of about 300 tons daily capacity each, giving a total capacity of circa 500 tons of raw ore daily, and will be erected and equipped as the first unit of a much larger plant, to which additions may be made from time to time, as circumstances render advisable. Other work planned for 1906 includes deepening the Mammoth shaft to 1,000′, and installing a 40-drill Nordberg air-compressor.

The Imperial Copper Co. has the same management as the Tombstone Consolidated Co., which is composed of experienced, capable and successful mining men and capitalists. The property is well handled, and gives promise of making a large and profitable mine.

IMPERIAL COPPER CO. **ONTARIO.**

Letter returned unclaimed from former office, Duluth, Minn. Organized November, 1899, to exploit bornite ore deposits in the Parry Sound district of Ontario.

IMPERIAL COPPER & GOLD MINING CO. **WYOMING.**

Mine office: Encampment, Carbon Co., Wyo. Was promoted in Milwaukee. Lands, on upper Cow Creek, are said to show a 30′ schist dike, carrying chalcopyrite in small quantities. Idle.

IMPERIAL COPPER MINING CO. **CALIFORNIA.**

Letter returned unclaimed from former mine office, Pollasky, Fresno Co., Cal. Property was the Painter mine, showing a vein of 4′ to 7′ width, traversing diabase and amphibolite schist, and carrying oxidized ores averaging 15% copper, with gangue of talcose schist. Has 3 shafts, deepest 110′. Idle for some years.

IMPERIAL COPPER MINING CO. **UTAH.**

Apparently merged in, or is controlled by, Nevada-Utah Mines & Smelters Corporation.

IMPERIAL GOLD & COPPER MINING CO. **UTAH.**

Succeeded, 1903, by Imperial Copper Mining Co.

IMPERIAL MINING CO. **WASHINGTON.**

Office: care of Jas. E. Dupree, president, Marysville, Wash. Mine office: Silverton, Snohomish Co., Wash. Lands, 11 claims, showing a contact vein between diorite and conglomerate, ores carrying gold, silver, copper and lead. Presumably idle.

IMPERIAL MONTANA COPPER MINING, SMELTING & WATER POWER CO. **MONTANA.**

Dead, 1903. Resurrected, circa 1904, as Bornite Copper Co.

IMPERIAL PAINT & COPPER CO. **CALIFORNIA.**

Mine office: Spenceville, Nevada Co., Cal. Otto Woehler, superintendent. Mine is developed open-cast, and has steam power.

IMPERIO COPPER CO. **MEXICO.**

Office: Tucson, Ariz. Lands are said to be near Imperio, Sonora, Mexico, which is not a postoffice.

INCA MINING & MILLING CO. **IDAHO.**

Office: Colfax, Idaho. Mine office: Cuprum, Washington Co., Idaho. M. O. Reid, superintendent, at last accounts. Property is the Mineral World mine, carrying auriferous and cupriferous silver-lead ores.

INDEPENDENCE COPPER & GOLD MINING CO. **UTAH.**

Office: care of E. O. Leatherwood, secretary-treasurer, Salt Lake City, Utah. Chas. Park, president; E. R. Morgan, general manager. Organized 1904, with capitalization $50,000, shares 10 cents par. Lands, 7 claims, in the Little Cottonwood district of Salt Lake county. Presumably idle.

INDEPENDENCE MINE. **MONTANA.**

An idle and slightly developed property, on the Tobacco Plains, near Kalispell, Flathead county, Montana, claimed to show a 25′ vein carrying 8% copper and $4 to $10 gold per ton.

INDEPENDENCE MINING CO. **COLORADO.**

Mine office: Turret, Chaffee Co., Colo. Ores carry copper and gold. Has steam power and employed circa 15 men, at last accounts.

INDEPENDENCE MINING CO. **IDAHO.**

Mine office: Mullan, Shoshone Co., Idaho. Lands adjoin the Copper King mine, on the east, and give a promising surface showing. Company plans cutting the vein, at depth, by an 800′ tunnel.

INDEPENDENCE MINING CO. **WYOMING.**

Office: care of H. O. Granberg, secretary and treasurer, 365 Tenth St., Oshkosh, Wis. Mine office: Dillon, Carbon Co., Wyo. Employs 4 men. E. W. Honchen, president and superintendent; C. G. Peterson, vice-president; Frank Earle, consulting engineer. Organized June 28, 1904, under laws of Wyoming, with capitalization $1,000,000, shares $1 par, as successor of the Leighton-Gentry Mining Co. Lands, 6 claims, patented, area 120

acres, in the Battle Lake district, showing eruptive metamorphic country rocks, carrying an 11′ contact vein between quartzite and diorite, opened by a 150′ shaft and a 250′ tunnel, showing occasional stringers of 3″ to 12″ width, carrying a little chalcopyrite, assaying 12% copper, with small quantities of nickel and cobalt, and traces of gold and silver.

INDEPENDENCE MINING & SMELTING CO. **MEXICO.**

Mine office; Guachinango, Jalisco, Mex. Said to have a reduction plant in operation, late in 1905.

INDEPENDENCIA MINING CO. **MEXICO.**

Office: St. Paul, Minn. Mine office: Ameca, Jalisco, Mex. C. D. O'Brien, manager. Has argentiferous copper ores, developed by a 300′ shaft and a 375′ tunnel.

INDEPENDENT MINING CO. **WASHINGTON.**

Office: care of Edward Peterson, 705 First Ave., Seattle, Wash. Mine office: Baring, King Co., Wash. Lands, sundry claims, on the north fork of Fortune Creek, Kittitas county, Washington, claimed by company to show 14 veins of galena, 2 gold veins, 1 cobalt vein, and an asbestos deposit, one gold vein being asserted to be 30′ to 70′ wide. The company claims too much.

INDÉ REDUCTION CO. **MEXICO.**

Works office: Indé, Durango, Mex. Is said to have a smelter, known as La Roca.

INDEX-BORNITE COPPER MINING CO. **WASHINGTON.**

Office: 36 Dexter Horton Bldg., Seattle, Wash. Mine office: Index, Snohomish Co., Wash. A. M. Watt, secretary and treasurer. Lands, about 3 miles from Index, show a 2′ vein, carrying bornite, giving assays of 16% to 50% copper and 6 oz. to 8 oz. silver per ton. Idle.

INDEX-HORSESHOE MINE. **WASHINGTON.**

Office: care of F. Danel, 217 Columbia St., Seattle, Wash. Mine office: Index, Snohomish Co., Wash. Idle some years.

INDEX INDEPENDENT MINING CO. **WASHINGTON.**

Dead. Lost lands, Jan. 1, 1905.

INDEX MINING CO. **WASHINGTON.**

Office: care of Lot Wilbur, president and general manager, Snohomish, Wash. Mine office: Index, Snohomish Co., Wash. Lands, 5 claims, known as the Miller mine, opened by tunnels of 300′ and 800′, showing chalcocite, bornite and chalcopyrite, in a 12′ vein of concentrating ore carrying a 2′ paystreak of smelting ore, on the footwall, values being mainly in chalcocite and bornite.

INDEX-PEACOCK MINE. **WASHINGTON.**

Office: care of F. Danel, 217 Columbia St., Seattle, Wash. Mine office: Index, Snohomish Co., Wash. A prospect, slightly developed. Idle for some years.

INDIANA-ARIZONA MINING CO. **ARIZONA.**

Mine office: Silver Bell, Pima Co., Ariz. Lands, sundry claims, in the Silver Hill Mountains.

INDIANA COPPER CO. **MICHIGAN.**

Office: 15 Willlam St., New York. John R. Stanton, president. Lands, 1,280 acres, in Sections 21, 27 and 28, Town 51 North, Range 37 West, Ontonagon county, Michigan. Paid in, on capital stock, $178,708. Has 2 shafts, each of 180′ depth, and expended $175,000, circa 1862-1865. Since idle.

INDIANA COPPER CO. **WYOMING.**

Mine office: Holmes, Albany Co., Wyo. Lands, 6 claims, near the Rambler mine. Idle.

INDIANA DEVELOPMENT CO. **ARIZONA.**

Mine office: Silver Bell, Pima Co., Ariz. Geo. H. Smith, manager. Lands lie south of the Imperial mine, in the Silver Hill Mountains, circa 7 miles from the Arizona Southern Railroad. Country rocks are limestone and quartzite, showing contact veins carrying sulphide ores, with limestone gangue, at depth of 55′ to 150′.

INDIANA MINING CO. **OREGON.**

Office: 25 Becker Bldg., Anderson, Ind. Mine office: Medical Springs, Baker Co., Ore. John W. Messner, president and general manager; J. W. McAlpine, vice-president; W. G. Drowley, secretary; Dr. W. J. Stapish, treasurer; Dr. A. L. Cleaver, auditor; W. L. Meyers, superintendent. Organized June 18, 1903, under laws of Oregon, with capitalization $1,500,000, shares $1 par. Lands, 14 claims, circa 25 miles east of Baker City, also a 280-acre townsite, bought June, 1905, showing strong outcrops and carrying a contact vein, between porphyry and greenstone, showing argentiferous and auriferous copper sulphides, with quartz gangue, averaging 2% to 3% copper, with occasional ore of higher grade. Main shaft is 330′, with circa 2,000′ of workings. Equipment includes a 3-ton Leyner hoist, good for 1,000′, a 4-drill Leyner air-compressor, 8 power drills and a small electric light plant. Buildings include a 16x30′ office, 40x70′ shafthouse, 40′ high, and a boarding-house. A precipitation plant is being built, this having 7 tanks, each 4x4x3′. Mine has about 5,000 tons of ore on the dumps, broken in development. Property is considered promising.

INDIANAPOLIS COPPER MINING CO. **WYOMING.**

Letter returned unclaimed from former mine office, Riverside, Carbon Co., Wyo. Lands, 14 claims, 6 miles southeast of Riverside. Has steam power.

INDIANA-SONORA COPPER & MINING CO. **MEXICO.**

Office: 99 John St., New York. Mine office: La Cananea, Sonora, Mexico. Employs 200 men. Jas. Douglas, president; Geo. Notman, secretary and treasurer; Walter Douglas, general manager; Geo. A. Laird, superintendent; R. A. Bryce, engineer. Lands, 164 pertenencias, showing country rocks of rhyolite quartzite and limestone, carrying at least four large and very irregular ore bodies, of nearly horizontal dip, main ore body showing a width of 300′, and a proven length of 600′, caryring chalcocite and chalcopyrite averaging about 4% copper. Development is by shafts of 400′, 300′, 300′, 100′, 200′, 100′, 150′, and 300′, and by the Llave tunnel, 1,800′,

and the Eureka tunnel, 1,200′. Mine has a total of 12,000′ of workings, with circa 400,000 tons of milling ore in sight. The Llave tunnel reaches the main ore body, which lies in ground adjoining the Capote mines of the Greene Consolidated.

The mine has 7 hoists, of 25 h. p. to 150 h. p., an air-compressor, power drills, and 25 buildings, including a 20x20′ carpenter shop, 25x50′ machine shop, 20x40′ smithy, office, laboratory, general store and dwellings.

In spring of 1906, ore-bins were being built at the mouth of the Llave tunnel, and a narrow-gauge railroad-line, to connect with the Greene Consolidated road, was being constructed, and it was planned to begin shipments shortly, to the Copper Queen smelter, at Douglas. Management is of the best, and property is regarded as likely to make an important low-grade mine.

INDIAN GROUP COPPER CO.

Has disappeared from former office, 1016-25 Broad St., New York. S. M. Biddison, president. Apparently an addled egg.

INDIAN QUEEN MINE. **MONTANA.**

Mine office: Apex, Beaverhead Co., Mont. Employs circa 75 men. Is owned by the Western Mining Co., but is held, under a $125,000 bond and lease, dated Dec. 8, 1904, by the Amalgamated Copper Co. Lands, one patented claim, area 20 acres, also a 3-acre millsite, in the Utopia district. Country rocks are granite, dolomite, and quartzite, showing 2 contact veins, between granite and limestone, averaging 8′ to 10′ width, developed by shafts of 150′ and 220′, and an 820′ tunnel, with 1,600′ of underground openings, estimated to show 50,000 tons of ore, with 10,000 tons blocked out for stoping. It is planned to sink the main shaft to 800′ depth. Property shows nearly every commercial ore of copper, except enargite, ores being mainly chalcocite and chalcopyrite, giving average returns of circa 9% copper, 4.5 oz. silver and 40c. gold per ton. Mine was opened 1867, and has been worked since, intermittently, by leasers. Has steam and gasoline power, with a smelter, connected by tramway with the shafts. Smelter has a 30-ton 36″ circular water-jacket blast-furnace, and, when operated, made matte averaging 55% copper, 27 oz. silver and 0.13 oz. gold per ton. Nearest railroad is the Oregon Short Line, 7 miles distant. Production, 1903, was about 700 short tons fine copper.

COMPAÑIA INGLESA DE MINAS. **CHILE.**

Local Chilean name for the Copiapó Mining Co., Ltd.

COMPAGNIE D'INGUARÁN. **MÉXICO.**

Office: Paris, France. Mine office: Inguarán, Michoacán, México. J. L. Phillips, manager. Employs circa 300 men. Is a close corporation, with capitalization 12,000,000 francs, controlled by the French branch of the Rothschild family, and a considerable proportion of the company's stock is owned by the Compagnie du Boleo. Price paid for the property was 1,500,000 pesos, Mexican, equal to $750,000.

Lands, 185 pertenencias, area 457 acres, also 5,000 pertenencias held under concession, in the Tacambara district, lying on the plateau of the volcano Jorullo, circa 1,600′ above the plains. The mountains form a succes-

sion of rugged, almost inaccessible peaks, with ore outcrops near their crests, these having a generally east and west trend, with widths of 90′ to 200′. Country rock is granite, in several stages of alteration, capped by a silicious limestone of 200′ to 300′ thickness. Ores of the district range 1.5% to 65% copper, with 2 oz. to 100 oz. silver and from a trace up to 1 oz. gold per ton. Ores of the Inguarán are almost exclusively sulphide, the ore body, of immense size, carrying disseminated chalcocite, chalcopyrite, and a little bornite, with granite-porphyry gangue, gold values being slight, but silver values considerable. Estimates of size and value of ore bodies vary greatly, but the best authorities give an estimated average value of 3.25% copper, with about 3,000,000 tons developed. The proven depth of the ore is about 300 metres, at which depth the ore body apparently cuts off. The ore is well suited for concentration, and it is planned to put about 8 or 10 tons into 1, before smelting. The mine is opened by a 2,500′ tunnel and 2 main shafts, deepest 350′, levels being opened every 80′. Both ore and country rock are exceedingly firm, and the mine will require little or no timbering.

The Inguarán has steam power, and has developed circa 200 h. p., at Mata de Plantano, 6½ miles from the mine, from a stream with an available head of 930′, flowing about 80 litres per second, and fed by springs that burst forth from the foot of Mt. Jurullo, about 150 years ago, after the last eruption of that volcano.

The company has secured complete surveys and plans for building a railroad line from the mines to Zihuatanejo, on the Pacific, south of Acapulco. The route of the proposed railroad traverses a rugged country, and the line would require several years to construct. Surveys also have been made for a short line, connecting the mines with the Uruapán branch of the Mexican National railway, which is about 75 kilometres distant.

Owing to its inaccessibility, and to the fact that the property is controlled by the Rothschilds, many misleading stories have been printed regarding the Inguarán, and the popularly accepted estimates of its richness, size and productive capacity, are much exaggerated. The mine has a large body of low-grade ore, and should make a considerable producer in time, but its ores are not equal, in quantity or quality, to those possessed by several other Mexican mines. Development is proceeding very cautiously and slowly, and, at the rate of previous progress, several years will be required to make the Inguarán a producer, and it is not probable that production be attempted until rail connections are secured.

INSPIRATION MINING CO. **ARIZONA.**

Mine office: Globe, Gila Co., Ariz. John D. Coplen, manager. Lands, sundry claims, in the Globe district, developed by 2 tunnels, known as the Mercer and Woodson. Company plans building a concentrator, and planned beginning shipments to the El Paso or Old Dominion smelters, in the spring of 1906.

INTERCOLONIAL COPPER CO. **NEW BRUNSWICK.**

Office: 702 Banigan Bldg., Providence, R. I. Mine office: Dorchester, Westmoreland Co., N. B. Darius L. Goff, president; T. J. Edwards, secre-

tary. Organized 1899, under laws of Arizona, and capitalization decreased, 1906, to $2,000,000, shares $5 par, in preferred and common shares, latter with restricted voting privileges. Lands, 250 acres freehold and 1,100 acres leasehold from the crown, showing a blanket vein carrying carbonate and sulphide ores, said to give returns of 3% to 4% copper. Has shafts of 40′, 75′, and 150′, also a 1,500′ drainage tunnel, with about 8,000′ of underground openings. The reduction works include a 200-ton concentrator, leaching plant, and electrolytic refinery. Equipment includes 2 boilers, 4 engines, crusher, rolls, 15 tubular roasting furnaces, six 300-ton leaching vats and two 50-kw. dynamos. The electrolytic plant has 550 lead cathodes, and 550 lead anodes, 22x33″ each, giving a plating surface of 5,000 square feet, for the deposition of electrolytic copper. Plant also includes tanks for precipitation of metal on scrap iron. The reduction plant did not prove satisfactory, machinery going wrong after making about 50 tons of fine copper. Company is out of funds, and property idle since 1904.

INTERIOR MINING & TRUST CO. **ARIZONA.**

Mine office: Wickenburg, Maricopa Co., Ariz. F. X. O'Brien, superintendent. Lands, sundry claims, in the Black Rock district, circa 16 miles east of Wickenburg. Company planned starting work early in 1906.

INTERMOUNTAIN GOLD & COPPER MINING CO. **IDAHO.**

Mine office: Pocatello, Bannock Co., Idaho. G. B. Rogers, president; Frank Ball, treasurer; G. A. Clark, secretary. Lands are the Lost Horse group, on the Ft. Hall Indian reservation, opened by a 50′ shaft, said to be bottomed in good ore.

INTERMOUNTAIN MINING & INDUSTRIAL ASSOCIATION. **UTAH.**

Letter returned unclaimed from former office, care of L. J. Moser, manager, Salt Lake City, Utah. Mine office: Bingham Canyon, Salt Lake Co., Utah. Lands, 10 patented claims, area 135 acres, bought 1905, from Mystic Shrine Gold & Copper Mining Co., in the West Mountain district, showing several ore bodies, of which one, ranging from 6″ to 20′ width, has given average assays of circa 6.5% copper, 18.8% lead, 10 oz. silver and $2 gold per ton, from chalcopyrite and galena, opened by 4 shafts, deepest 200′, and 8 tunnels, longest 700′, with circa 3,000′ of underground workings. Has steam power and is reached by the Copper Belt railroad. Company said to plan installing a mill to treat low-grade ores.

INTERNATIONAL CONSOLIDATED SMELTING & MINING CO. **MEXICO.**

Office: care of Dr. J. M. Bishop, president, 12 West 38th St., New York. Wm. L. Saunders, secretary. Organized January 1, 1904, by merger of Mexican Lead Co. and Guaynopa Smelting & Reduction Co. Lands of latter, 254 pertenencias, area 133 acres, in Guaynopa Cañon, district of Guerrero, Chihuahua, Mexico, show ores carrying 5% to 8% copper, with good silver values. Company was promoted by Daugherty & Albers, with the assistance of C. B. James. None of the promotions of Daugherty & Albers are regarded favorably.

INTERNATIONAL COPPER CO. **COLOMBIA.**

Office: 71 Broadway, New York. Wm. R. Townsend, president;

Arthur F. Carmody, vice-president; Wm. H. Martin, secretary and treasurer. Organized October, 1900, under laws of Arizona, with capitalization $1,000,000, shares $1 par. Lands, 2,300 acres, near Natagaima, Tolima, Colombia, claimed to give a good copper showing. Company apparently is merely a bluff, so far as actual mining is concerned.

INTERNATIONAL COPPER CO. **UTAH.**

Merged, 1903, in Dirigo-La Sal Gold & Copper Mining Co.

INTERNATIONAL COPPER CO., LTD. **ARGENTINA.**

Offices: 56, Cannon St., London, E. C., Eng. Capt. W. B. McTaggart, chairman; A. Dangerfield, secretary. Organized July 7, 1905, with capitalization £100,000, shares £1 par; issued, £25,000. Was formed to finance the Famatina Development Corporation, Ltd., having bought £20,000 debentures and £20,000 income bonds of that company, and having agreed to advance £60,000 additional, at 6%, for the erection of a smelter, if required.

INTERNATIONAL COPPER CORPORATION, LTD. **NEW CALEDONIA.**

Dead. Lands sold, 1900, to Caledonian Mining Corporation.

INTERNATIONAL COPPER & GOLD CO. **COLORADO, MONTANA & MEXICO.**

Office: 1122–135 Adams St., Chicago, Ills. Albert G. Beaunisne, president; A. P. Ballou, secretary and treasurer; W. C. Hermbuecher, general manager; Gad Freeman, superintendent. Organized 1899, under laws of Arizona, with capitalization $3,000,000, shares $1 par. Lands, 149 claims, area circa 400 acres, in Routt county, Colorado, Madison and Missoula counties, Montana, and in the states of Sonora and Sinaloa, Mexico. Has a shaft of 280′ in Montana, and a 60′ shaft in Colorado. Ores are sulphide in Colorado, carbonate in Montana, and carbonate and oxide in Mexico. The Escalanta group, in Colorado, is undeveloped. The Montana properties are in name of Montana Copper & Gold Mining Co., and the Mexican lands are in name of Santa Fé Gold & Copper Mining Co. Both of latter named corporations are controlled, through majority stock interest, by the International Copper & Gold Co. Apparently all properties are idle. Not favorably regarded.

INTERNATIONAL COPPER MINING CO. **ARIZONA.**

Office: P. O. Box 530, Hancock, Mich. Mine office: care of Carl Clausen, general manager, Bisbee, Cochise Co., Ariz. Fred. J. Bawden, president; R. Mount Beattie, secretary; Geo. H. Nichols, treasurer. Organized May 18, 1903, under laws of Arizona, with capitalization $3,000,000, shares $10 par. Lands, 14 patented claims, near Solomon Springs, 6 miles southeast of Bisbee, in the Warren district. Idle since birth.

INTERNATIONAL COPPER MINING & MILLING CO. **WYOMING.**

Office: care of F. M. Dunn, Minneapolis, Minn. Letter returned unclaimed from former mine office, Encampment, Carbon Co., Wyo.

INTERNATIONAL EXPLORATION & INVESTMENT CO. **ARIZONA.**

Succeeded, circa 1902, by Lady Helen Copper Mining Co.

INTERNATIONAL GOLD & COPPER CO., LTD. **ONTARIO.**

Office: Mooney-Brisbane Bldg., Buffalo, N. Y. M. M. Wall, president;

G. W. Stanley, treasurer; E. F. Goff, secretary; R. E. Erdmann, superintendent; Organized under laws of Arizona, with capitalization $3,000,000, shares $1 par. Lands, sundry claims in the Hastings district of Frontenac county, Ontario, developed by a 100′ shaft. Presumably idle.

INTERNATIONAL GOLD & COPPER MINING CO.

Office: 62 Commercial Blk., Salt Lake City, Utah.

INTERNATIONAL GOLD-COPPER MINING CO. **BRITISH COLUMBIA.**

Dead. Lost lands, at Rossland, circa 1899.

INTERNATIONAL MINE. **MEXICO.**

Office: care of H. E. Dugan & Co., owners, Douglas, Ariz. Lands, sundry claims, circa 15 miles south of Douglas, on the Nacozari railroad, Arizpe district, Sonora, showing a 2′ to 6′ quartz vein, carrying carbonate ores assaying 3% to 30% copper, 6 oz. silver and occasionally a little gold, developed by shafts of 20′ to 50′.

INTERNATIONAL MINE & INVESTMENT CO. **MEXICO.**

Office: care of E. F. Fisher, secretary, Douglas, Arizona. Dr. W. E. Lindley, president; J. M. French, treasurer; S. C. Morrison. superintendent. Lands, 108 pertenencias, adjoining lands of the Santa Rosa Development Co., about 4 miles from the Nacozari railroad, in the Arizpe district of Sonora, Mexico, showing oxide and carbonate ores, giving good assay values in copper, lead and silver, with small gold values. Also owns sundry mineral lands in the Mulatos district of Sonora, circa 200 miles south of Santa Rosa.

INTERNATIONAL MINING CO. **COLORADO.**

Mine office: Black Hawk, Gilpin Co., Colo. Geo. F. Johnstone, manager, at last accounts. Ores carry gold, silver and copper. Has steam power.

INTERNATIONAL MINING CO., LTD. **ONTARIO.**

Office: care of V. E. Metzger, secretary and treasurer, Sault Ste. Marie, Mich. C. S. Beadle, general manager. Lands, 1,400 acres, known as the Brady location, lying east of the Mississagua river, in Patton and Thompson townships, 30 miles east of Sault Ste. Marie and 5 miles from Dean Lake station, Algoma, Ontario, opened by 12 test pits, deepest 24′, showing a 3′ vein, carrying chalcopyrite, assaying 5% to 28% copper, with small gold and silver values. Idle, at last accounts.

INTERNATIONAL MINING & REFINING CO. **CHILE.**

Mine office: Chañaral, Atacama, Chile. Operates a group of old mines, at Chañaral, and is developing mines in the Huantajaya district.

INTERNATIONAL NICKEL CO.

Office: 43 Exchange Place, New York. Ambrose Monnell, president; Col. Robert M. Thompson, chairman executive committee; Jas. L. Ashley, treasurer; Stephen H. B. Bell, secretary. Organized March 30, 1902, under laws of New Jersey, with capitalization $24,000,000, shares $100 par, half in 6% non-cumulative preferred and half in common stock; outstanding, $8,912,626 preferred and $8,822,661 common stock. Debentures, $10,000,000 authorized, at 5%; issued, $9,982,836.

Company is a securities holding corporation only, controlling, through stock ownership, the Canadian Copper Co., Vermilion Mining Co., Orford

Copper Co., Anglo-American Iron Co., Nickel Corporation, Ltd., Société Miniere Caledonnienne and American Nickel Works, also holding extensive stock interests in the Société le Nickel and other companies. Is commonly known as the Nickel Trust, and while not absolutely controlling the world's nickel supply, is the dominant factor in that industry, and, through the Canadian Copper Co., is a considerable producer of copper. Net earnings for the first year, ending March 31, 1903, were $559,000, and for the fiscal year, ending March 31, 1905, net earnings were $1,430,382, leaving, after payment of bond interest, adjustments and ample allowances for depreciation, a surplus of $324,379. During the fiscal year 1905, borrowed money, to the amount of $1,000,000, was repaid.

INTERNATIONAL SMELTING CO. **MEXICO.**

Office: Kansas City, Mo. Mine office: Suaqui de Batuc, Ures, Sonora, Mexico. Capitalization $1,000,000, shares $1 par. Is said to plan building a smelter for various mines in the Suaqui de Batuc district, none of which are as yet on a productive basis, with operations seriously hampered by depredations of the Yaqui Indians.

INVESTORS MINING & PROSPECTING CO. **WYOMING.**

Office: care of C. B. Bergquist, secretary, P. O. Box 132, Encampment, Wyo. Mine office: Rambler, Carbon Co., Wyo. Aaron Slothower, president and general manager; L. S. Niece, vice-president. Organized July 19, 1904, under laws of Wyoming, with capitalization $1,000,000. Lands, 8 claims area circa 120 acres, in the Battle Lake district, showing country rocks of schist, diorite and quartzite, carrying a contact vein, between schist and quartzite, ranging up to 22′ width, with a gossan showing some oxide and carbonate ores, changing to chalcopyrite, at a little depth. Has a 110′ shaft. Idle.

INYO COPPER MINES & SMELTERS CO. **CALIFORNIA.**

Office: 312 Pine St., San Francisco, Cal. Mine office: Keeler, Inyo Co., Cal. Employs 10 men. R. G. Paddock, president and general manager. T. J. Fitzsimmons, vice-president; Philip S. Montague, secretary; H. L. Wrinkle, engineer. Organized July 3, 1905, under laws of Arizona, with capitalization $1,000,000, shares $1 par. Lands, 21 claims, area 415 acres, showing limestone, granite and grano-diorite country rocks, with porphyrytic intrusions, carrying 8 contact veins, between limestone and porphyry or grano-diorite, showing a little native copper, malachite, azurite, chalcopyrite and chrysocolla, in veins of 2′ to 40′ width, giving average assays of 12% copper, 6 oz. silver and $75 gold per ton. Development is by shafts of 35′, 60′ and 80′ and by tunnels of 50′ and 60′. Company plans making circa 1,500′ of openings during 1906, and adding a gas hoist and power drills.

IOWA-NEW MEXICO MINING CO. **NEW MEXICO.**

Letter returned unclaimed from former mine office, Scheherville, N. M.

IRIGOYEN HERMANOS y CA. **MEXICO.**

Mine office: Huetamo, Michoacán, Mexico. Produced 48.9 metric tons fine copper, in 1902.

IRISH MINES. **ARIZONA.**

A group of 7 claims, in the Greenlee district of Graham county, Arizona,

said to show a vein of 10′ to 15′ width, carrying oxides and altered sulphide ores, with values up to 15% copper, opened by a 100′ tunnel. Idle.

IRON CAP MINING CO. **ARIZONA.**

Out of business. Lands sold to National Mining Exploration Co.

IRONCLAD COPPER MINING CO. **OREGON.**

Office: care of Dr. P. L. Mackenzie, Portland, Ore. W. H. Warren, secretary. Lands, 10 claims, in the St. Helen's district of Skamania county, Washington, on which 2 veins, giving average assay values of about $25 per ton, from copper, gold and silver, have been slightly developed. Presumably idle.

IRON CROWN GROUP. **ALASKA.**

Sundry claims, near the Hetta Mountain group, Copper Harbor, Prince of Wales Island, Alaska. Considered promising, but idle for some time.

IRON DYKE COPPER CO. **OREGON.**

Office: Erie, Pa. Mine office: Homestead, Baker Co., Ore. Employs 12 men. C. N. Conrad, president; H. G. Fink, vice-president; A. A. Clauss secretary; F. F. Curtze, treasurer; preceding officers, Geo. R. Metcalf and Davenport Galbraith, directors; Frank E. Pearce, superintendent. Organized under laws of Pennsylvania, with capitalization $500,000, shares $100 par. Litigation over title is said to have been adjusted. Property shows considerable ore, on the dumps and blocked out for stoping.

IRON FALLS GOLD & COPPER MINING CO.

Letters returned from former office, 713 New York Blk., Seattle, Wash.

IRON HEAD & REPUBLIC MINES **NEW MEXICO.**

Owned by Gilchrist & Dawson, Inc.

IRON HORSE MINING & MILLING CO. **ARIZONA.**

Mine office: Globe, Gila Co., Ariz. Organized 1904, with capitalization $500,000. Presumably idle.

IRON KING EXTENSION MINING CO. **ARIZONA.**

Office: 66 Broadway, New York. A Douglass, Lacey & Co. swindle.

IRON KING MINE. **ARIZONA.**

There are two Iron King copper mines in Yavapai county, Arizona. One is owned by the American Copper Co., the other by the Equator Mining & Smelting Co., each being described under its respective corporate title.

IRON KING MINE. **COLORADO.**

Office: care of F. A. Sidelinger, Old Orchard, Me. Property, in Gilpin county, Colorado, is said, by owners, to give a promising showing of ores carrying gold, silver and copper values.

IRON MASK MINE. **BRITISH COLUMBIA.**

Owned by Kamloops Mines, Ltd.

IRON MOUNTAIN COPPER CO. **UTAH.**

Said to have claims in Iron county, Utah, on which a little work, done 1902, under management of Duncan J. Frew, showed ores carrying copper, lead, silver and gold.

IRON SILVER MINING CO. **COLORADO.**

Offices: 416-40 Exchange Place, New York, and 523 Stevens Bldg., Detroit, Mich. Mine office: Leadville, Lake Co., Colo. Ashley Pond, president·

W. R. Cobb, vice-president; Homer A. Hoit, secretary; Fremont Woodruff, treasurer; preceding officers, Hon. Thos. W. Palmer, Henry G. Stevens, DeForest Paine, Samuel E. Reinhardt, Anson G. McCook, Jos. Greenough and Winfield Scott, directors; Waldemar Arens, financial agent; John F. Walsh, manager. To end of 1905, paid 43 dividends, aggregating $6,000,000, and begun 1906 on the basis of 20 cent quarterly dividends, amounting to $400,000 yearly. Net proceeds, 1904, were $267,035.64, and year was ended with a surplus of $209,600.30. The Nisi Prius Consolidated Mining Co. is controlled, through stock ownership, and is leased to 3 different parties. Principal mine is opened by the Tucson shaft, 925′ deep, on the eastern crest of Iron Hill, which, early in 1906, was entering a 185′ ore body, previously located by diamond drilling. The Dome shaft is operated also. Ores are mainly sulphides, carrying principal values in zinc, silver and lead. Production, 1904, was 45,805,699 lbs. zinc, 3,608,351 lbs. lead, 948,902 lbs. copper, 950,067 oz. silver, and 3,049 oz. gold. Property is well equipped and well managed.

MINA ISABEL. **MEXICO.**

Office and mine: care of Jesús M. Celaya y Ca., owners, Saric, Sonora, Mex. Is a slightly developed copper prospect, presumably idle.

ISABEL COPPER MINING CO. **WYOMING.**

Lands sold, October, 1902, to Rambler Mining & Smelting Co.

ISHPEMING & BISBEE DEVELOPMENT CO., LTD. **ARIZONA.**

Attempted organization, 1903, under this title, was not effected.

ISLAND CITY COPPER MINING CO. **WYOMING.**

Office: Eaton Rapids, Mich. Letter returned unclaimed from former mine office, Saratoga, Carbon Co., Wyo. Idle and apparently moribund.

ISLAND MOUNTAIN CONSOLIDATED COPPER CO. **CALIFORNIA.**

Lands, 7 claims, in Trinity county, near the Mendocino county line, California, opened by a 490′ tunnel and by several open-cuts, showing a vein ranging up to 130′ width and traced for about 800′, capped by large boulders carrying copper and iron sulphides. Property considered promising. Idle.

ISLE ROYALE CONSOLIDATED MINING CO. **MICHIGAN.**

Succeeded, March, 1899, by Isle Royale Copper Co.

ISLE ROYALE COPPER CO. **MICHIGAN.**

Office: 303-199 Washington St., Boston, Mass. Mine office: Houghton, Houghton Co., Mich. Employs circa 400 men. Albert S. Bigelow, president; Norman W. Haire, vice-president and general manager; Wm. J. Ladd, secretary and treasurer; preceding officers, Clarence H. Bissell and Edgar Buffum, directors; Wm. J. Uren, general superintendent; James E. Richards, mine superintendent; James G. Glanville, mill superintendent; Chas. D. Hohl, chief engineer; John T. Reeder, chief clerk and purchasing agent; H. D. Haddock, clerk; Edward Colenso, chief mining captain.

Organized March, 1899, under laws of New Jersey, as a consolidation of the Isle Royale Consolidated Mining Co. and the Miners' Copper Co., with capitalization $3,750,000, shares $25 par. Annual meeting, first Wednesday in April, at Jersey City. The Isle Royale Copper Co. owns $50,000 stock in the Lake Superior Smelting Co.

Lands, 3,240 acres, and an 80-acre millsite, including the old Isle Royale, Grand Portage and Huron mines, the Dodge and Frue prospects and sundry undeveloped lands, with an option on the mineral rights of the Montezuma tract of about 250 acres, lying next west. Lands include all of Sections 1, 2 and 11, and part of Sections 3, 9, 10 and 15, in T. 54 N., R 34 W., also 160 acres in 6-54-33; 40 acres in 31-55-33 and 160 acres in 36-55-34, giving a compact tract carrying circa 2½ miles of the strike of the lodes.

The three old mines included in the present Isle Royale tract made 24,226 tons, 590 lbs. fine copper, of which the Huron furnished 17,883 tons, 225 lbs., the Isle Royale 4,602 tons, 71 lbs., and the Grand Portage 1,741 tons, 294 lbs. These products were secured uuder primitive conditions, and at a loss of about $2,500,000. The old Isle Royale and Grand Portage mines were opened in 1853, and the Huron in 1855. The history of all three is given in detail in Vol. I.

The Isle Royale has 3 parallel amygdaloida beds, with strike of N. 32° E. and dip of 56°, of which two have been extensively opened, these being the Isle Royale and Portage, the latter lying approximately 200′ west of the former. The new shafts are on the Isle Royale lode, but the Portage bed is opened on many levels by crosscuts. East of the amygdaloids is the "Mabbs vein," lying near the Eastern Sandstone, 4′ to 7′ wide and rich in mass and barrel copper, but deficient in stamp rock. It was opened to a depth of about 250′, by John and Austin Mabbs, circa 1875, but has not been reopened by the present management. There also are unidentified and unexplored copper bearing amygdaloids lying west of the Portage, and occasional occurences of narrow fissure veins, carrying arsenical copper ores.

No. 1 shaft, near the northern boundary, had 3 compartments and was 1,335′ deep. The Portage lode, lying 150′ to 220′ to the westward, was reached by 5 crosscuts, on the 11th to 15th levels, inclusive, and about two miles of drifts were opened thereon. This shaft was completely gutted by fire, December, 1903, and has not been rebuilt. When working, stoping in No. 1 was about equally divided between the Isle Royale and Grand Portage beds, these amygdaloids being markedly similar in characteristics and values.

No. 2 is a 3-compartment shaft, 1,335′ deep, located 2,280′ southwest of No. 1. Skip-tracks are laid with 45-lb. rails. The Isle Royale lode only was stoped from No. 2, before the burning of No. 1, but since then the south drifts of No. 1, on both lodes, have been made tributary to No. 2. Concrete dams have been built across the south drifts of No. 1, at the 13th and 14th levels, holding back the mine water, and surface water is collected on the 8th level and sent to No. 2 shaft, for forking out. Several of the southern drifts have been discontinued, because approaching the old Huron mine workings, filled with water, of which no accurate maps are available. Twenty power drills are used in No. 2 shaft. Work on the Portage bed, during 1905, was of a somewhat negative nature, and was discontinued before the end of the year, owing to beginning exploratory work on the Baltic lode.

In addition to the two new shafts there are 28 old shafts, in the three old mines, and masonry dams have been built underground, at various points,

to hold back the waters in the old openings. The Isle Royale bed is 80′ in extreme width, in certain levels of No. 10 Huron, the southernmost of the old shafts, and the lode is supposed to have been lost in the bottom levels, at the southern end of the Huron. The mine has about 8 miles of new openings, in addition to circa 3 miles of stoped-out openings in the old Isle Royale and Grand Portage mines, and about 5 miles in the Huron. The mine has stopes opened for three to four years ahead of requirements, and no sinking has been done since 1902.

In 1904 a new shaft was opened, on Section 11, the Isle Royale lode having been located previously by diamond drill borings. This shaft, tentatively known as No. 11, is about 7,300′ southwest of No. 2, and near the center of Section 11. The shaft found but a few feet of overburden, and opened phenomenally good ground, rich in mass, barrel and stamp copper. Developments have shown that the principal values at this point favor the footwall. The drifts do not show as rich ground as the shaft, but are in ground of good average grade. The lode shows much epidote, and developments are promising. No. 11 has 2 levels, opened at 120′ intervals, and carries laterals as drift-stopes, ore being shipped as mined, with a daily production of about 30 tons. Equipment includes a temporary hoist and an 8-drill air-compressor. A shaft was started, 1904, on Section 10, but was discontinued because of the heavy overburden encountered, and a diamond drill substituted, the drill-cores showing an amygdaloid, about 5′ of which carries stamp copper in fine grains.

Exploratory work on the Baltic lode was begun October, 1905, on Section 12. In July, 1906, this shaft was down circa 300′, but for its entire depth was in a badly disturbed formation, barren of copper. It is hoped that at greater depth the formation may grow more settled, in which probable contingency, copper values may be anticipated with reasonable assurance. Equipment at the Baltic shaft is of a temporary nature only.

Shafts Nos. 1 and 2 have duplicate equipments, with combination shaft-rockhouses, 44x60′ on the ground, and 90′ high, fitted with 18x24″ and 13x20″ Portage Lake crushers. Each shaft has a 3,000-ton coal-trestle and a 35-drill Nordberg two-stage air-compressor. The engine-houses are 50x90′, of steel on stone foundations. The hoists have 18′ 6″ drums, with lathe-turned grooves for 6,000′ of 1½″ steel cable, built to hoist 6-ton skips from a depth of 6,000′. Boiler-houses are 44x72′, with 16x72′ coal-storage additions, each housing three 150-h. p. 84″ horizontal Burt boilers. The 40x60′ machine shop, of steel on stone foundations, is well equipped. A dam, 300x500′ in area and 6′ deep, impounds feed-water for boilers. There are about 100 good dwellings, mostly new, on the company's lands.

The Isle Royale Railroad, owned by the company, connects the mine and mill with 4 miles of main line having easy grades, and is equipped with one 35-ton and one 55-ton locomotive, and forty 40-ton steel rock-cars having air-brakes.

The millsite, at the mouth of the Pilgrim river, has nearly one mile frontage on Portage Lake. The mill, 134x210′, of steel frame on stone

foundations, has three 2,000-ton rock-bins and three 500-ton Nordberg stamps with circular mortars and $\frac{3}{8}$" screen openings. Each stamp has 32-ton mortars, resting on anvil blocks bedded on 20x20′ platforms, 3′ thick, of 14x24"x20′ oak timbers. Underneath each platform is a caisson, reaching to bedrock, made of 5-16" boiler steel, 74′ long, and 12′ in diameter, until near the top, where there is a bell-shaped flare, 20′ in diameter, to support the oak platforms under the anvil blocks. The caissons and spaces between are filled with concrete. The dressing floor has 72 rough jigs and 30 finisher jigs, of the Parnall-Krause type, slime-tables, and 1 Bartlett and 2 Wilfley concentrators to treat the slimes from the circular tables. There is a complete machine-shop on the second floor of the mill. A 750-h. p. engine runs the mill and shop, taking steam from four 250-h. p. boilers, in a 46x72′ boiler-house at the rear of the mill. During 1904 new crushers with fixed bearings were installed, to regrind the coarse gravel escaping from the mortars. One head was compounded, with superimposed cylinders, March 1, 1905, and results are said to be satisfactory. In addition to rock from its own mine, the Isle Royale mill stamps the production of the Ahmeek mine. A 32x600′ wharf, at the millsite, with deep water alongside, has appliances for unloading coal and general freight, and for dispatch of mineral, in scows, to the smelters at Dollar Bay, 2 miles across Portage Lake.

Water is furnished the mill by a 16,000,000-gallon Nordberg Corliss pump, especially designed to handle muddy water, having a triple discharge into a 30" riveted steel water-main running 2,200′ from pump-house to mill, the pump being located some distance from the mill, to obviate stamp-sand clogging the intake. Three 100-h. p. boilers furnish power for the pumps, fuel being taken from a large coal-trestle at the rear of the pump-house boiler-rooms, feed-water coming from a dam near the mill.

Production, 1902, was 3,569,748 lbs. fine copper, in 1904, 2,442,905 lbs., and in 1905, 2,973,761 lbs. Cost of copper made was 11.83 cents per pound in 1903, 13.3 cents per pound in 1904, and 12.76 cents per pound in 1905. Production of fine copper, per ton of rock stamped, was 11.7 lbs. in 1901; 13.5 lbs. in 1902; 15.8 lbs. in 1904 and 15.2 lbs. in 1905. Milling costs were but 24.77 cents per ton in 1905, and total mining and milling costs for 1905 were only $1.40 per ton—a very creditable achievement.

The Isle Royale has proven a disappointment, but by virtue of ample resources, including a large cash surplus, a magnificent equipment, and prudent management, remains a producer, and with copper at a high price, can and does earn small profits. The hope of a prosperous future lies mainly, however, in the discovery and development of richer mines than those yet opened. The policy of the management in continuing production from the old mine, and persistently seeking a newer and better mine, is the only correct one.

ISLE ROYALE LAND CORPORATION, LTD. **MICHIGAN.**

Offices: 24, North John St., Liverpool, Eng. Local office: care of Rufus R. Goodell, agent, Houghton, Houghton Co., Mich. Reginald Young, chair-

man; John Tibbs, secretary. Organized June 21, 1890, as Wendigo Copper Co., Ltd., and name changed to present title July, 1901. Capitalization £225,000, shares £5 par, in 2,000 first preference, 1,089 second preference and 41,911 ordinary shares. Preference shares, all issued and fully paid; 34,504 ordinary shares issued, £4 paid in. Lands, 83,720 acres, mainly copper-bearing, upon the northern fold of the Keweenawan syncline, on Isle Royale, Lake Superior, Michigan, comprising the major portion of the area of this, the largest fresh water island of the globe. Considerable mining, of a rather desultory nature, has been done upon these lands, at various periods in the past, and some copper secured. Idle since 1892.

ITMAY MINE. **WYOMING.**

Office: care of I. C. Miller, Rawlins, Wyo. Mine office: Rambler, Carbon Co., Wyo. Albert Bryle, superintendent. Lands, sundry claims, circa 4 miles south of Rambler, opened by a 300′ shaft, showing 8′ of sulphide ore carrying occasional native copper, claimed to average 30% copper and 4% to 5% lead. Mine also has a 20′ vein, carrying a 3′ paystreak of high grade ore. Is said to plan building a concentrator, during 1906.

ITSUKI MINE. **JAPAN.**

Mine office: Itsuki-mura, Kuma-gori, Higo, Japan. Ore is chalcopyrite, associated with iron pyrites, averaging 5% to 6% copper, in veins interbedded in clay-slates. Production, 1900, was 1,080,163 lbs. fine copper.

IVANHOE MINE. **BRITISH COLUMBIA.**

Mine office: Alberni, Vancouver Island, B. C. Has a 140′ crosscut tunnel. Idle at last accounts.

IVANHOE MINING CO. **UTAH.**

Letter returned unclaimed from former mine office, Bingham Canyon, Salt Lake Co., Utah.

IVANPAH CONSOLIDATED SMELTING CO. **CALIFORNIA.**

Dead.

IVANPAH MAMMOTH GOLD & COPPER MINING CO. **CALIFORNIA.**

Mine office: Ivanpah, San Bernardino Co., Cal. Capitalization $2,000,000, shares $1 par; issued, $1,100,000. Lands, 22 claims, 12 owned outright and 10 under option, area 435 acres, 12 miles west of Ivanpah, claimed to show a ledge 300′ wide and 6,000′ long, carrying argentiferous and auriferous copper and lead sulphides, giving surface assays of $9 to $105 per ton, which it is planned to develop by tunnel.

JACK POT MINING & MILLING CO. **WYOMING.**

Office: care of H. O. Granberg, secretary and treasurer, 365 Tenth St., Oshkosh, Wis. Mine office: Coppertown, Carbon Co., Wyo. Employs 4 men. Ole Granberg, president and general manager; H. Thorsgaard, vice-president; J. M. Riggs, superintendent. Organized December 23, 1903, under laws of Wyoming, with capitalization $1,000,000, shares $1 par. Lands, 9 claims, area 186 acres, patented, in the Battle Lake district, showing fissure veins in diorite and chloritic schist, and 2 contact veins carrying carbonate and sulphide ores, between diorite and porphyry. Two veins are under development, one said to average 14′ and the other 60′ width.

The smaller vein has given average assays of 8% copper and $8 to $12 gold per ton, the larger vein showing very low grade copper ore. Development is by a 75′ tunnel, 100′ shaft and 8 pits of 20′ to 36′ depth, with 411′ of workings. Company plans continuing development and producing 20 to 40 tons of ore daily, before close of 1906.

JACK TAR COPPER CO. **ARIZONA.**

A swindle, promoted by the notorious Wm. F. Wernse gang, of St. Louis.

JALISCO COPPER MINING CO. **ARIZONA.**

Letter returned unclaimed from former office, 135 South Broadway, Los Angeles, Cal. Mine office: Nogales, Santa Cruz Co., Ariz. A. R. Noon, president; W. J. Stevens, secretary. Organized under laws of Arizona, with capitalization $1,000,000, shares $1 par. Lands, 8 claims, area 160 acres, near Oro Blanco, Pima Co., Ariz. Apparently was a mere stock-jobbing device, and presumably is defunct.

JALISCO MINING & DEVELOPMENT CO. **MEXICO.**

Office care of Dennis Ryan, St. Paul, Minn. Mine office: Ahualulco, Jalisco, Mexico. Was organized, circa 1906, to take over the property of the Altamira Mining Co.

JAMAICA COPPER CO. **JAMAICA.**

Letter returned unclaimed from former office, Baltimore, Md. Organized January, 1903, with capitalization $1,000,000. Lands, 1,000 acres, claimed by company to be heavily timbered with logwood, satinwood, ebony, cedar and walnut. Company claims that shipments of ore to England have returned 22.31% copper. Proposition is regarded with much suspicion.

JANOS MINING CO. **MEXICO.**

Letters returned unclaimed from former office, 218 New York Life Bldg., Kansas City, Mo. Mine office: Casas Grandas, Chihuahua, Mexico. A. Hanley, president; Chas. M. Lewis, secretary and treasurer. Organized under laws of Arizona, with capitalization $1,000,000.

JAPAN-FLORA MINES & TUNNEL CO. **COLORADO.**

Office: 310 Colorado Bldg., Denver, Colo. Mine office: Telluride, San Miguel Co., Colo. T. Walter Beam, president and general manager: Wm. E. Humphreys, secretary. Organized August 22, 1903, under laws of Colorado, with capitalization $2,000,000, shares $1 par. Lands, 35 patented claims, area 317 acres, in the upper San Miguel district, showing 8 fissure veins, in brecciated andesite, carrying auriferous and argentiferous galena and iron pyrites, with quartz gangue, averaging about 0.5% copper, 10% lead, 8% zinc, 23.5 oz. silver and $10 gold per ton, opened by a 685′ shaft and 8 crosscut tunnels, two longest 1,600′ and 2,752′, with 19,655′ of underground openings, estimated to give 150,000 tons of ore blocked out for stoping. Has steam and electric power, with a 45-h. p. hoist, 2 Leyner air-compressors, power drills and shops. Property has produced considerable ore. Closed down, October, 1905, and idle at last accounts.

JARILLA COPPER CO. **NEW MEXICO.**

Reorganized, 1903, as Three Bears Copper Co.

JARILLA MINING & SMELTING CO. **NEW MEXICO.**

Mine office: Jarilla, Otero Co., N. M. Lands, 20 claims, held under 5-year bond and lease, expiring 1909. Presumably idle.

JASPER COPPER CO. **CANADA.**

Office: 22 Lewis Blk., Buffalo, N. Y. Letter returned unclaimed from alleged mine office, Port Arthur, Ont. E. K. Corbett, president and general manager; Dr. F. J. Carr, vice-president; B. H. Wilson, secretary and treasurer. Capitalization, $5,000,000. Lands, sundry claims, circa 40 miles east of Port Arthur, opened by a 40′ shaft and 75′ tunnel. Idle several years, and apparently moribund.

JASPER MOUNTAIN COPPER CO. **WYOMING.**

Mine office: Douglas, Converse Co., Wyo. Presumably idle.

JEFFERSON COPPER CO.

A swindle, promoted by the notorious Wm. F. Wernse gang, of St. Louis.

JEFFERSON COPPER MINING CO. **COLORADO.**

A swindle, perpetrated by the notorious W. C. Calhoun, of Denver.

JEFFERSON COUNTY MINING CO. **MONTANA.**

Mine office: Basin, Jefferson Co., Mont. Organized for purpose of leasing the mine of the Basin & Bay State Mining Co. Apparently is mixed up somehow with La France Copper Co. Inactive.

JEFFERSON-MONTANA COPPER MINES CO. **MONTANA.**

Office: care of Clarence K. McCornick, vice-president and general manager, Salt Lake City, Utah. Letter returned unclaimed from former mine office, Corbin, Jefferson Co., Mont. Arthur H. S. Bird, president and superintendent; C. H. Post, secretary and treasurer; preceding officers, H. A. McCornick and B. T. King, directors. Organized 1904, to take over about one-half of the Wickes and O'Connell groups, 39 claims, near Corbin. Did some diamond drilling, during 1905.

JEFFS LAND CO. **MICHIGAN.**

Office: Rockland, Ontonagon Co., Mich. Lands, 800 acres, north and west of Rockland, on which a little exploring work was done, 1899–1900. Fully described in Vol. I.

JELM TOWNSITE & MINING CO. **WYOMING.**

Office: Kasota Blk., Minneapolis, Minn. Mine office: Jelm, Albany Co., Wyo. Organized Jan. 2, 1903, under laws of South Dakota, with capitalization $2,000,000, shares $1 par. Idle and presumably dead.

JENNIE DELL MINING CO. **MONTANA.**

Succeeded, 1905, by Columbus-Butte Mining Co.

JEROME CAÑON COPPER CO. **ARIZONA.**

Office: 106½ South Broadway, Los Angeles, Cal. Mine office: Granite, Yavapai Co., Ariz. J. W. Tibot, president; G. B. Tibot, secretary; Jos. S. Smith, superintendent. Organized 1901, under laws of Arizona, with capitalization $1,000,000, shares $1 par. Lands, 16 claims, including the Copper Glance group, 14 miles northwest of Jerome, showing a vein ranging from 2′ to 7′ wide, with circa 1,500′ of openings, ore from which has given assays up to 28% copper, 60 oz. silver and $110 gold per ton. Has steam power, air-com-

pressor, power drills, hoist and pumps. Information refused and company apparently moribund.

JEROME COPPER CO. **ARIZONA.**

Succeeded, 1902, by Cleopatra Copper Co.

JEROME MINES DEVELOPMENT CO. **ARIZONA.**

Office: care of Lloyd C. Haynes, 20 Broad St., New York. Mine office: Jerome, Yavapai Co., Ariz. C. L. Bleakley, president; W. C. Lawrence, vice-president; J. R. Kinney, secretary and treasurer; W. J. Mitchell, superintendent. Capitalization $1,000,000, shares $1 par. Lands, 8 claims, area 100 acres, known as the Harryhousen group, near Jerome, on the line of the United Verde & Pacific Railroad, and lying next north of the United Verde mine. Development is by a 200′ tunnel, claimed to show a 104′ vein, giving assays of $5 per ton in gold and silver, with traces of copper. Ground is being tested by diamond drilling, which is proving difficult, owing to a broken formation. It is planned to drill to depth of 1,000′ or 1,500′.

JEROME SILVER-COPPER MINES CORPORATION. **ARIZONA.**

Presumably dead. Letters returned unclaimed from former office and former mine office.

JESSIE BELLE MINING, MILLING & SMELTING CO. **CALIFORNIA.**

Office: 302 Lankershim Bldg., Los Angeles, Cal. Mine office: Daulton, Madera Co., Cal. W. H. Sallada, president; W. T. Carter, secretary. Organized 1902, under laws of Arizona, with capitalization $1,500,000, shares $1 par. Lands, 3 patented claims, area 40 acres, with a 200′ main shaft showing 4 fissure veins, carrying oxide, carbonate and sulphide ores, assaying 15% to 20% copper, 6 oz. to 10 oz. silver and $8 to $15 gold per ton. Has steam power, air-compressor and a 30-ton concentrator. Has shipped concentrates netting $240 to $620 per car.

JESSIE MINES CO. **ARIZONA.**

Organized under laws of Arizona, with capitalization $2,500,000, shares $1 par. Claims to have lands in Yavapai county, Arizona, and has paid dividends while peddling stock, hence safely may be set down as a more than dubious proposition.

MINA JESÚS MARIA DE BAQUERÁCHIC. **MEXICO.**

An old property, once of importance, near the Lluvia de Oro mine, in the state of Chihuahua, Mexico. Ores are copper sulphides, carrying about 5 oz. silver and $2 gold per ton.

JESÚS MARIA MINES CO. **MEXICO.**

Letter returned unclaimed from former mine office, Parral, Chihuahua, Mexico. Property includes the Jesús Maria mine, a silver property, in Parral, idle since 1902, owing to water and decreased ore values. Company also owned a copper property at San Juan de Herredia, in El Carmen district, south of Parral, also idle since 1902, presumably for similar reasons.

JICARILLA MINING & REDUCTION CO. **NEW MEXICO.**

Office: 108 La Salle St., Chicago, Ills. Mine office: Jicarilla, Lincoln Co., N. M. Geo. E. Emery, president; H. G. W. Reinhardt, secretary; Wm. A. Franklin, manager; J. L. Walsh, mill superintendent. Lands are developed

1906, as a reconstruction of the Sonora Mining & Milling Co. Present property is a gold mine only, with about 2 miles of openings.

JUDAS MINE. **WYOMING.**

Letter returned unclaimed from former mine office, Encampment, Carbon Co., Wyo. Lands, sundry claims, near the Doane mine, opened by a 50′ shaft, said to show copper ore.

MINA JUEZ. **MEXICO.**

Office and mine: Ameca, Jalisco, Mexico. José Somerla, owner.

JUMBO MINE. **BRITISH COLUMBIA.**

Mine office: Rossland, Yale district, B. C. Mine shows a vein ranging up to 30′ and more in width, developed both underground and open-cast, with ores carrying from $7 to $20 per ton in gross values. Has steam and electric power, air-compressor, etc., and plans building a 6,000′ aerial tram from mine to the Columbia & Red Mountain railway line. Shipped about 12,000 tons of ore to the Granby smelter, 1904, but was idle, at last accounts.

JUNCTION DEVELOPMENT CO. **ARIZONA.**

Succeeded, October, 1905, by Junction Mining Co.

JUNCTION MINING CO. **ARIZONA.**

Office: Calumet, Mich. Mine office: Bisbee, Cochise Co., Ariz. Chas. Briggs, president; James Hoatson, vice-president; Thomas Hoatson, second vice-president; Louis W. Powell, third vice-president and general manager; Gordon R. Campbell, secretary; Peter Ruppe, treasurer; preceding officers, Thos. F. Cole, Chester A. Congdon, Chas. d'Autremont, Jr. and Geo. E. Tener, directors; Henry B. Paull, auditor; J. C. Collins, mine foreman; E. E. Whiteley, engineer. Organized October, 1905, under laws of Minnesota, as successor of Junction Development Co., with capitalization $3,000,000, shares $10 par; issued, $2,500,000. Of the issued stock, 150,000 shares were given shareholders of the Junction Development Co., at the rate of three shares for one, and 100,000 shares were sold, shareholders of the Junction Development Co. subscribing for entire stock issue. Merchants & Miners Bank, Calumet, Mich., registrar. Annual meeting, second Monday in April. Is very closely allied, in ownership and management, with the Calumet & Arizona, Lake Superior & Pittsburg, Pittsburg & Duluth and Calumet & Pittsburg mining companies, and is to be merged, by means of a securities holding corporation, with four last named properties.

Lands, 18 claims, area 185 acres, patented, lying an eighth to a quarter mile southeast of Sacramento Hill, a 300′ gossan blossom which is the keystone to the semi-circular copper measures of the proven portion of the Bisbee basin. The Junction has the Copper Queen and Calumet & Pittsburg to the west, and the Calumet & Pittsburg to the south. The major portion of the Junction tract is covered by the Bisbee conglomerate, flanked on either side by porphyry and limestone. It was the theory of the Junction management that the limestone underlaid the conglomerate, in which contingency the chances of finding large and rich copper ore bodies were excellent. Acting upon this hypothesis, considerable diamond drilling was done, and two ore bodies were located, by means of these borings, at a depth of about 820′. Permanent de-

velopment is by a 4-compartment shaft of 1,037′ depth, sunk on the boundary line of the Junction and Calumet & Pittsburg, and to be used jointly by these properties. Connection has been made with the Briggs shaft on the 910′ level, formerly called the 770′ level of the Junction, shaft of the latter being 140′ below the collar of the Briggs shaft. The drift connecting these shafts showed leached ore in considerable quantities, presaging large ore bodies of good ore at greater depth. The north drift on the 910′ level has cut some rich carbonate ore, and the east drift of 500′, on the same level, is in leached ore carrying rich carbonate stringers for practically its entire length. The shaft is to be deepened, and levels opened, sinking having been delayed by the necessity of providing for the handling of an immense volume of water, which heretofore has been pumped by the deeper Briggs shaft. The pump station, on the 910′ level, has four 800-gallons pumps, which were forking circa 2,700 gallons per minute, early in 1906.

The shaft, has a 75′ steel gallows-frame, for 5 compartments, and the permanent hoist was installed early in 1906. This is a Nordberg engine, similar in plan to, but smaller than, the hoists at No. 5 shaft of the Tamarack mine, the deepest shaft of the world, and is a duplicate of the new hoist at the Oliver shaft of the Calumet & Arizona, these being the most powerful in Arizona. The hoist has four 20x48″ cylinders, and is good for 3,000′ depth. The machinery plant, located at the mouth of the shaft, is of 1,500 aggregate horse-power, including also minor hoists with 12x14″ and 12x15″ cylinders, and two cross-compound air-compressors, of 12 drills aggregate capacity Fuel is crude petroleum, stored in three 5,000-gallon tanks. The mine is served by a short spur of the El Paso & Southwestern railway, and has the great advantage of close connection with other developed and developing mines, in the immediate neighborhood, and enjoys a management that stands deservedly high for experience, ability, financial strength and absolute honesty.

JUPITER MINING CO. **WYOMING.**

Office: Tomah, Wis. Mine office: Holmes, Carbon Co., Wyo. Dr. C. E. Quigg, president; J. A. McKay, vice-president; J. W. Hancock, secretary and treasurer. Lands, sundry claims, adjoining the New Rambler, on the southwest. Idle at last accounts.

JURA-TRIAS COPPER CO. **NEW MEXICO.**

Office: Commercial Club Bldg., Albuquerque, N. M. Mine office: Señorito, Sandoval Co., N. M. Thos. J. Curran, president; Geo. W. Stubbs, secretary and treasurer. Organized October, 1900, under laws of New Mexico, with capitalization $1,000,000, shares $1 par. Lands, sundry copper claims and a gold mine, located circa 35 miles from a railroad, showing large bodies of low-grade ore, giving average assays of 3.8% copper. Has a 25-ton smelter and has been experimenting with a new reduction process.

JUSTICE MINING CO. **COLORADO.**

Mine office: Central City, Gilpin Co., Colo. Lands, sundry claims, carrying ores of gold, silver and copper. Presumably idle.

KAFUE COPPER DEVELOPMENT CO., LTD. **RHODESIA.**

Offices: Salisbury House, London, E. C., Eng. Tom Donald, secretary. Organized May 31, 1905, with capitalization £350,000, shares £1 par; issued, £200,007. Lands include the Hippo mine, area 160 claims, 2 farms, area 3,000 acres, and 3 areas of 10 square miles each, all on the Kafue river, in northern Rhodesia.

KAUFE COPPER SYNDICATE, LTD. **RHODESIA.**

Absorbed, 1904, by Rhodesia Copper Co., Ltd.

KAFVELTORPS KOPPARVERK. **SWEDEN.**

In Orebro Län, Sweden. Output, 1901 was 112,590 kgs. of matte averaging 72% copper, (equal to 178,713 lbs. fine copper), and 16,423 kgs. refined copper, giving a net production, 1901, of 214,919 lbs. fine copper, with considerable values in lead and silver, obtained as by-products.

KALAMAZOO COPPER MINING CO. **COLORADO.**

Office: 232 West Cedar St., Kalamazoo, Mich. Letter returned unclaimed from former mine office, Encampment, Wyo. H. E. Brown, president; E. S. Drury, vice-president; Edwin Gillis, secretary and general manager; W. C. Carson, treasurer. Organized April 11, 1902, under laws of Wyoming, with capitalization $1,000,000, shares $1 par. Lands, 10 patented claims, area 95 acres, in the Pearl district of Larimer county, Colorado, carrying 2 fissure veins, opened by 28′ and 40′ shafts, showing oxide and sulphide ores assaying 2% to 50% copper, with variable values in gold, silver, nickel and zinc. Is under same management as the Coldwater mine, adjoining, and is permitting the Coldwater to develop to the boundary line. Idle for several years.

KAMIOKA MINE. **JAPAN.**

Owned by Mitsu Bishi Gosshi Kwaisha.

KAMLOOPS MINES, LTD. **BRITISH COLUMBIA.**

Offices: 18, Leadenhall St., London, E. C., Eng. Mine office: Kamloops, Yale district, B. C. Employs 65 men. G. P. Symons, chairman; J. Morrish, manager and secretary; Jos. Argall, general manager. Organized February 22, 1905, as successor of British Columbia Exploration, Ltd., with capitalization £135,000, shares £1 par; paid in, £119,433. Lands, 7 claims, in the Kamloops district, and 5 claims in the Frederick Arms district. Property includes the Iron Mask mine, having a 600′ main shaft, with circa 1 mile of underground workings, showing a considerable body of chalcopyrite, associated with magnetite, mainly of concentrating grade, carrying fair values in copper, silver and gold. Mine equipment includes a 250-h. p. tandem-compound condensing engine.

The reduction plant includes a concentrating mill and smelter. The mill, of 160 tons daily capacity, receives ores by aerial tram. Ore is screened on grizzlies, and coarse stuff passed through a 10x16″ Jenckes-Farrel crusher, going thence to ore-bins, whence crushed ore is fed to coarse rolls by 2 automatic feeders, going thence through intermediate rolls and being elevated to 2 series of trommels. Sized material from the trommels is concentrated on Hartz jigs. Tailings from finer sizes are run to waste, while tailings from coarse jigs and oversize from trommels are recrushed by fine rolls and returned

to the elevators. Fines from trommels pass through 3 magnetic separators, for removal of the magnetite gangue. Sands are concentrated on 3 Buss tables, and middlings from these go to the Overstrom tables. Slimes run to a series of settling tanks, products of which are concentrated on 6 Luhrig vanners, arranged in pairs. The smelter, completed July, 1905, is of 50-ton capacity only, planned as the first unit of a larger plant. Property has a good management and is considered promising.

KANGAROO HILLS MINING & SMELTING CO. **AUSTRALIA.**

A consolidation of the Macaulay Creek Silver & Copper Mines and the Mt. Theckla Copper Mine, in the Kangaroo Hills district of Queensland. The Mt. Theckla, opened 1900, produced 23 tons of copper and 6,315 oz. silver, 1901, from ores averaging 16% copper, 15% lead and 49 oz. silver per ton. Has a smelter, located on the Running river, midway between the mines. Presumably idle.

KANSAS-BURROUGHS CONSOLIDATED MINING CO. **COLORADO.**

Letter returned unclaimed from former office, Denver, Colo. Mine office: Central City, Gilpin Co., Colo. Ores carry gold, silver and copper. Has steam power. Presumably idle.

KANSAS CITY COPPER MINING & SMELTING CO. **COLORADO.**

Office: Kansas City, Mo. Mine office: Oneco, Routt Co., Colo. Oliver W. Kroll, superintendent, at last accounts. Has steam and electric power and a 40-ton smelter. Presumably idle.

KANSAS CITY FIREMEN'S COPPER MINING & SMELTING CO.

Office: 310 Kemper Bldg., Kansas City, Mo.

KANSAS CITY GOLD & COPPER MINING & MILLING CO. **COLORADO.**

Incorporated, August, 1902, to develop mines in Saguache county, Colorado. No traces found of operations.

KANSAS CITY & SONORA MINING & MILLING CO. **MEXICO.**

Property sold, 1903, to Ures Consolidated Mining Co.

KAPUNDA COPPER MINE, LTD.

Dead. Planned to, but did not, take over the Kapunda mine.

KAPUNDA MINE. **AUSTRALIA.**

Office and mine: care of Varley & James, owners, Kapunda, South Australia. Mine, 50 miles north of Adelaide, opened 1842, and worked by tributors, circa 1879-1901, has 8 shafts, 2 deepest being about 450′ each. Water level is 50′ below surface. Vein matter and country rock are very soft. Mine has produced at least $1,000,000 worth of copper, and carries oxide, carbonate and sulphide ores, with a little native copper, ores averaging about 18.5% in tenor.

KARANKULSKI MINE. **TURKESTAN.**

A small property, near Tashkent, Turkestan, operated in a crude way.

KARGALINSKI WORKS. **RUSSIA.**

Office and works: Orenburg, Russia. E. O. Terner, manager, at last accounts. Latest reported production, 1899, was 680 674 lbs. fine copper.

COMPAGNIE DU KATANGA. **CONGO FREE STATE.**

Office: Rue Brederode, Brussels, Belgium. Edouard Despret, chairman; Col. A. Thys, managing director; Major A. Cambier, manager; A. J. Wauters, secretary. Organized April 15, 1901, under laws of Belgium, as a subsidiary corporation of the Belgium Congo Company, with capitalization 3,000,000 francs. Lands, 50,000,000 acres, freehold, with sundry preferential mining and railway rights. Mining property is four groups, known as the Katanga, Kambove, Kazemba and Pala, located on the left bank of the upper Lualaba river, showing auriferous copper ores. Development, in charge of Grey & Holland, African managers of the Tanganyika Concessions, Ltd., has not advanced beyond an exploratory stage, but the showing is said to be promising.

KATARSKI MINE. **RUSSIA.**

Office: care of H. Lorenz, Elizabethpol, Russia. Production, 1899, was officially reported by the Russian Government as approximately 4,765,000 lbs. fine copper.

KATHARINE ELIZABETH CONSOLIDATED MINING CO. **ARIZONA.**

Mine office: Jerome, Yavapai Co., Ariz. Geo. O. Ford, president and general manager; L. O. Ford, secretary and treasurer. Organized 1904, under laws of Arizona, with capitalization $1,000,000, shares $1 par. Lands, 4 claims, in 2 groups, near Jerome Junction, in the Mineral Point district, opened by a 175′ tunnel and several shafts of 25′ to 125′ depth. Was out of funds and idle, at the beginning of 1906.

KAWADAYAMA MINE. **JAPAN.**

Mine office: Sanyama-mura, Oe-gori, Awa, Japan. Ore is chalcopyrite, mixed with iron pyrites, averaging 4% copper, in a 2′ to 4′ vein in amphibolite. Production, 1900, was 14,834 lbs. fine copper.

KEARNS CONSOLIDATED COPPER MINES CO. **WYOMING.**

Succeeded April 18, 1904, by Keystone Mining & Development Co.

KEARSARGE MINING CO. **MICHIGAN.**

Absorbed, 1897, by Osceola Consolidated Mining Co.

BERG- UND HÜTTENWERKE KEDABEG. **RUSSIA.**

Office: care of Gebrüder Siemens, owners, Berlin, Germany. Mine office: Kedabeg, Elizabethpol, Russia. Property is called also the Kiadebek and Kedabenski mine. Is an old mine, reopened, 1864, by present owners, under whose management it has been a considerable producer, for four decades.

Ore occurs as irregular lenses, often of considerable size, in veins with quartz-porphyry gangue, having diorite on the east and diabase porphyrite on the west, with considerable tufa. The lenses shade gradually into the country rocks, with very indistinct partings. There have been 16 different lenses developed, these ranging from 6′ to 165′ wide, 16′ to 165′ deep and 33′ to 820′ long. Richest ore favors the hanging wall as a rule. The ore is a mixture of covellite, chalcopyrite, sphalerite, pyrite and pyrrhotite, with occasional galena, accompanied by barytes in considerable quantities, and is slightly auriferous and argentiferous, averaging 3% to 5% in copper tenor. The mine is is developed almost exclusively by tunnels and the caving system of winning ore is employed to some extent. Rock is broken by Siemens & Halske electric

drills. The broken ore is assorted, on surface, into three grades, the first being smelting ore, of 7% average copper tenor, all ores of 5% or upwards being smelted. Second grade ore, of between 2% and 5% tenor, is leached, and the third grade, of 2% copper or less, is sold to the petroleum refineries at Baku, for the making of sulphuric acid, which is used extensively in the refining of illuminating oils. Wages are low, ranging from 36 to 62 cents daily, for miners, and 26 to 32 cents for trammers.

The property has two smelters, the larger being at the mines, while the smaller is at Kalakent, 8 miles from Kedabeg and circa 40 miles from Elizabethpol. The works are open, no covering being provided for any department, which seems a somewhat doubtful economy, and causes occasional explosions, in time of rain. Fuel is mainly petroleum, of which circa 20,000 tons are burned annually. This is piped 29 miles, from Dalliar, on the Trans-Caucasian railway, to Kalakent and Kedabeg. Petroleum is used for general steaming purposes, for burning bricks, and for roasting, smelting and refining copper, 2,700 lbs. of crude oil being required to produce 3,600 lbs. fine copper from ore, while weight for weight of petroleum is required to refine precipitate to blister copper. The oil burned has a specific gravity of 0.882, and contains 87.4% carbon, 12.5% hydrogen and 0.1% oxygen, with a heating value of 11,700 calories. In practice it is assumed that 54 parts of petroleum, by weight, are equivalent in heating value to 100 parts of bituminous coal, or 250 parts of wood. Petroleum is sprayed into the reverberatories under high pressure.

Ore reaches the works as about 40% lumps and 60% fines. Lumps are kiln-roasted, and raggings, of ¼" to ½" size, are roasted in reverberatory furnaces, while ores under ¼" size are roasted in Gerstenhoefer kilns. Smelting is done exclusively in reverberatory furnaces, of which there are 6, circular in form, instead of oval, as formerly, 7 metres in diameter, with a depth of charge of 1 to 1.2 metres. Hearths are laid of quartz, in layers, or crushed quartz worked into a paste with water. The first-fusion product is a matte of 25% to 30% copper tenor, an average matte carrying 28.6% copper, 36.7% iron, 19.7% sulphur, 4.06% zinc, 0.85% nickel and cobalt combined, 0.10% lead, 0.05% arsenic, 0.025% silver and 0.0014% gold, with small quantities of silica, sesquioxide of aluminum and barium sulphate. The first-fusion matte is broken into lumps, roasted, and blown up to blister copper of low grade, averaging 88% to 90% copper, 25 oz. silver and 1.2 oz. gold per ton, which is refined at Kalakent, product being a homogeneous copper, largely used for sheets, but less desirable for brass.

Production, 1900, was circa 4,500,000 lbs. fine copper, and for 1904 was only 2,966,720 lbs. fine copper, decline being due to gradual exhaustion of old ore bodies, which are not being replaced by new discoveries as rapidly as exhausted.

KEDABENSKI MINE. **RUSSIA.**

Described under title Berg- und Hüttenwerke Kedabeg.

KUPFERKIESBERGBAU KELCHALPE. **AUSTRIA.**

Mine office: Kelchalpe, Tyrol, Austria. Is a very small producer.

KELLER & INDIANA CONSOLIDATED SMELTING CO. WASHINGTON.

Mine and works office: Keller, Ferry Co., Wash. Had a reduction plant, including a 50-ton sampling mill, 50-ton lead furnace and 160-ton copper matting furnace, under construction, in spring of 1906. Water is supplied by a 4x5′ flume, 1½ miles long, taking water from the Sans Poil river. Company is supposed to own mining lands also, in the vicinity of the works.

KELVIN COPPER MINING CO.

Office: 43-89 State St., Boston, Mass.

KELVIN REDUCTION CO. ARIZONA.

Mine office: Kelvin, Pinal Co., Ariz. Frank E. Sharp, superintendent. Property includes the Ray mine, and lands leased from the Big Lead Mining & Smelting Co. A 35-ton leaching plant has been built, and is operated on a secret process, invented by H. P. McIntosh. It is claimed for this system that it will do in minutes what others processes require hours to accomplish. Only carbonate ores are treated, but sulphides are said to be amenable to treatment after roasting, and the installation of a calcining plant is planned. The plant, located on Mineral Creek, 5 miles from Kelvin, is terraced, all material being handled by gravity. Power is furnished by a 125-h. p. engine and air-compressor, and the company plans enlarging the works and doing a general custom business.

KEMP-KOMAR MINING CO. WASHINGTON.

Mine office: Loon Lake, Stevens Co., Wash. A. W. Kemp, manager. Ores are oxide and carbonate above and sulphide in lower workings, carrying small gold and silver values, in a 12′ vein with paystreak of 6″ to 5′. Carload shipments have returned 16% to 20% copper. Idle.

KEMPTON MINE. UTAH.

Office: care of Col. Enos A. Wall, owner, Salt Lake City, Utah. Mine office: Bingham Canyon, Salt Lake Co., Utah. Fred Bemis, superintendent. Lands, in the West Mountain district, carry argentiferous and auriferous lead and copper sulphides, values being mainly in lead. The mill, of circa 125 tons daily capacity, was rebuilt, 1905, and is running on ore from the Phœnix. The mill is unique, inasmuch as practically all the machinery was designed by the owner. The equipment includes a set of Wall corrugated rolls, a set of steel rolls for middlings, also invented by Col. Wall, 3 sets of Wall jigs, 2 Wall tables for concentrates, and 2 Wilfley tables.

KENDRICK & GELDER SMELTING CO. COLORADO.

Succeeded, 1903, by San Juan Smelting & Refining Co.

KENNEBEC MINING CO. UTAH.

Office: care of W. J. Craig, manager, Salt Lake City, Utah. Letter returned unclaimed from former mine office, Alta, Salt Lake Co., Utah. Lands are upwards of 400 acres, lying in the Big Cottonwood district slightly developed by tunnel, and considered well located.

KENNETT MINING CO. MONTANA.

Mine office: Virginia City, Madison Co., Mont. W. B. Millard, general manager, at last accounts. Ores carry gold and copper. Has steam power and a 60-ton stampmill.

KENTUCKY-ARIZONA MINING, SMELTING & DEVELOPMENT CO. **ARIZONA.**

Office: 504 Kentucky Title Bldg., Louisville, Ky. Mine office: Cave Creek, Maricopa Co., Ariz. Frank Clifford, president; Wm. Votteler and P. H. McDonald, vice-presidents; Shirley M. Crawford, secretary and treasurer. Organized under laws of Arizona, with capitalization $2,500,000, in $250,000 preferred and $2,250,000 common stock. Lands, circa 50 claims, in 5 groups, lying in Maricopa and Yavapai counties, including the Copper Top mine, area 480 acres, formerly held by the Lime Creek Consolidated Gold & Copper Co. The Copper Top is opened by several shafts and tunnels, and shows numerous small veins of ore, of rather low grade. The Copper Top property includes 10-ton and 60-ton smelters, built some years ago, and the larger smelter may be removed to Cave Creek. The property has shipped a little ore, averaging better than 17% copper and $3 gold per ton, with small silver values.

KENTUCKY GULCH MINING CO. **COLORADO.**

Mine office: Tin Cup, Gunnison Co., Colo. Ores carry gold, silver and copper. Has steam power. Presumably idle.

KEREMOS COPPER MINES, LTD. **BRITISH COLUMBIA.**

Mine office: Olalla, East Yale district, B. C. Dr. A. C. Sinclair, president; E. N. Ouimette, secretary and treasurer; R. W. Northey, superintendent. Organized December, 1900, with capitalization $1,000,000, shares $1 par. Has a few shallow shafts and short tunnels, showing a 6′ vein with 18″ paystreak of mispickel, carrying 5% to 15% copper. Works a few men, summers only.

KEREMOS-PONTIAC MINES, LTD. **BRITISH COLUMBIA.**

Office: care of Wheeler & Co., 32 Broadway, New York. Mine office: Olalla, Yale district, B. C. R. W. Northey, superintendent. Lands, 16 claims, in 2 groups, opened by numerous shallow pits and several short tunnels. A 20′ shaft shows a 5′ vein carrying a little native copper. Property is said to have 5 ore bodies, carrying mainly chalcopyrite, associated with phyrrotite, arsenopyrite and garnetite, average assays giving 2% to 4% copper, 2 oz. to 4 oz. silver and $2 to $5 gold per ton. Property is idle winters, on account of heavy snowfall. Property is considered promising, but promoters are not well regarded.

KEREMOS SMELTING & REFINING CO. **BRITISH COLUMBIA.**

Dead. Outstanding stock said to possess an equity in a liquidation fund.

KESWICK SMELTING WORKS. **CALIFORNIA.**

Owned by Mountain Copper Co., Ltd.

KETCHIKAN COPPER CO. **ALASKA.**

Office: care of W. D. Lamb, secretary and treasurer, Seattle, Wash. Mine office: care of Victor Vigelius, president, Ketchikan, Alaska. Capitalization $2,500,000. shares $1 par. Lands, 5 claims, area 100 acres, held on 2-year bond and lease, about 3 miles east of Coppermount, Prince of Wales Island, Alaska, also 2 gold-silver claims on Kulu Island, about 2 miles from Kell Bay. Copper claims regarded as promising.

KEWEENAW ASSOCIATION. **MICHIGAN.**

Office: 33-87 Milk St., Boston, Mass. J. M. Longyear, agent, Marquette, Mich. A land corporation, owning large tracts in the upper peninsula of Michigan, a portion of the lands being on the Keweenawan copper belt.

KEWEENAW COPPER CO. **MICHIGAN.**

Office: 45 Broadway, New York. Operating office: Hancock, Mich. Chas. A. Wright president and treasurer; Spencer R. Hill, vice-president; Thomas Hoatson, second vice-president and mining director; Chas. A. Wright, Jr., secretary; John C. Shields, railway superintendent; W. W. Stockley, engineer; A. H. Sawyer, assistant engineer.

Organized March 13, 1905, under laws of Michigan, with capitalization $10,000,000, shares $25 par; issued, $3,750,000, $10 paid in. Cash on hand, Jan. 1, 1906, was $345,683.97. Adams Trust Co., Boston, registrar; City Trust Co., Boston, transfer agent. Annual meeting, second Tuesday in February. Capitalization was purposely made much larger than the immediate requirements of the company, to provide for future growth, plan on which the corporation was formed providing for the absorption of large tracts of mineral lands, the building of a railroad, erection of mills and smelters, etc. A very considerable part of the purchase price of lands acquired has been paid by the issue of stock.

Lands, 11,550 acres mining lands, 920 acres timber lands, and 385 acres miscellaneous lands, giving total holdings of 12,855 acres, all in Keweenaw county, Michigan. Lands are in three main groups, carrying the strike of the Keweenawan mineral belt for a distance of circa 14 miles, the tract carrying practically all of the amygdaloidal and conglomerate cupriferous beds of the district, as well as many copper-bearing cross-fissures. Lands are in Town 58 North, of Ranges 27, 28 and 29 West, and include the tracts formerly owned by the Ætna, Empire, Girard, Keweenaw, Mandan, Medora Philadelphia & Boston, Resolute and Vulcan mining companies. In addition to strictly mineral lands, the company has secured sundry tracts of value for future extensive milling operations, giving large water-frontages on available harbors, and undeveloped water-powers of great prospective value The Longyear tract, of 1,500 acres, gives, with former holdings, nearly two miles of water-frontage on either side of the Montreal river, including Fish Cove, one mile east of the river's mouth, which might be made a good harbor, by a comparatively small outlay. This frontage will be available for stampmills, and as the site of a power plant and a railroad terminal and harbor. It also includes 5 miles of the course of the river, on both banks, and, with other holdings, gives the company the entire water frontage of Mosquito Lake. It will be possible to use Mosquito Lake for a storage reservoir, by throwing a dam across its outlet, and thus developing a great water power, with a power plant at the mouth of the river. The property of the company also includes the Lac La Belle or Mendota ship canal, one mile in length, connecting Lac La Belle with Lake Superior. The canal has a 14′ channel, and leads to a splendid harbor, which should be made a harbor of refuge by the federal government.

The company has a complete diamond drill outfit, and will probe its property extensively, preliminary to beginning actual mining operations. Work was started, on the Resolute property, in a search for the westerly extension of the Montreal River amygdaloid bed, which is being developed, with very promising results, on the old Delaware mine, by the Manitou Mining Co., a subsidiary corporation of the Calumet & Hecla Mining Co. This is supposed to have been located, the drill cores therefrom showing well in copper, and the drill was put at work searching for the northern extension of the Kearsarge amygdaloid bed, on the Resolute tract. The old Resolute mine had a 379′ shaft, with circa 2,000′ of drifts.

An office is being built at the Mandan property, this being centrally located. The Ætna mine produced 140,581 lbs. fine copper, from desultory operations, 1863-1873. In 1906 the Keweenaw Copper Co., secured control of the Washington mine, in the Mosquito Lake district.

The Keweenaw Copper Co. secured control of the Lac La Belle & Calumet railroad, and organized the Keweenaw Central Railroad Co., to rebuild and extend this line. The entire stock issue of the Keweenaw Central Railroad Co., $350,000 is owned by the Keweenaw Copper Co. The old Lac La Belle line, only 8 miles in length, has been rebuilt and the line extended southwest, for circa 25 miles, toward Calumet, where connections will be secured with the Mineral Range and Copper Range railroads, and thereby with a number of private railway lines, owned by various mining companies of Calumet and vicinity. The main line south to Ripley and [illegible] during the latter half of 1906. A [illegible] the Manitou, Medora and Resolute properties of the Keweenaw Copper Co., and it is planned to [illegible] Montreal river.

Mr. C. A. Wright, the president of the [illegible] promoter of the Copper Range railroad, [illegible] to stand in somewhat similar [illegible] county that the Copper Range [illegible] Range, which includes portions of [illegible] development of the upper peninsula [illegible] pered greatly in the past by the lack [illegible] necessary to successful mining in any [illegible] of inadequate transportation facilities [illegible] county, outside of the extreme [illegible] as the Mohawk, Adams and Allouez [illegible] tensions of several of the Hancock [illegible] Copper Co., through its railroad [illegible] important factor in securing the [illegible] interests of Keweenaw county and [illegible] some good mines is a prediction [illegible]

KEY CITY COPPER CO.

Office: care of Lacy Manning [illegible] Sacramento Cal. Mine office [illegible]

F. W. McCrady, superintendent. Property adjoins the Tyee and Lenora, and is opened by tunnel. Has steam power. Presumably idle.

KEYSTONE COPPER CO. **ARIZONA.**

Office: Bank of Commerce Bldg., St. Louis, Mo. Mine office: Globe, Gila Co., Ariz. G. S. Maddox, president; A. A. Aal, vice-president; Geo. A. Biddle, secretary; J. R. Finletter, general manager; Jos. C. Erman, general superintendent; John Herman, metallurgist. Organized, 1905, with capitalization $1,000,000, shares $1 par. Lands, 12 claims, known a the Keystone Group, formerly worked by Finletter & Harvey, lying 8 miles west of Globe, next east of the Live Oak and near the Inspiration mine. A good wagon-road is being built to the property.

Country rocks are granite and quartz-porphyry, with occasional schists. Ores are mainly chrysocolla, carrying disseminated carbonates, with occasional sulphides, including chalcocite ranging 40% to 60% in tenor. East of the main workings there are surface deposite of chrysocolla, assaying 3% to 7% copper, also a conglomerate blanket vein of 4′ to 12′ thickness, impregnated with copper to the extent of 3% to 6%, from which values apparently can be recovered by leaching. Development is by 3 tunnels, with circa 2,000′ of workings, and it is planned to sink a 3-compartment 500′ shaft, for large extraction. Principal vein has a 12′ ore-body, carrying a 15″ paystreak averaging 22% copper and 2 oz. to 5 oz. silver per ton. Balance of vein, of concentrating grade, running 3% to 5% in copper tenor, is left standing, for mining later. No. 2 tunnel, 570′ long, shows chrysocolla and carbonate ore of 4% to 24% tenor, and No. 3 tunnel, 600′ long, also shows good ore. Property has furnished a small production of silicious ore, of 3% to 5% copper tenor, to the Old Dominion smelter, for convertor linings.

A 25-ton experimental leaching plant was built in 1905. The system used is a modification of the Hoepfner sulphide process, and is designed for leaching chrysocolla, as well as carbonate ores, and can include sulphide ores after roasting. Ore is reduced to fines, pulped, and leached for three hours in a slowly revolving chlorination barrel. The leaching solution is cupric chloride, which is changed to cuprous chloride by the absorption of one atom of copper. The enriched solution goes to precipitation tanks, where the extra molecule of copper is precipitated upon large copper sheets, and the solution, thus regenerated to cupric chloride, is returned to the storage tank, for further use.

Grading was being done, April, 1906, for a 100-ton roasting furnace, to enable the works to treat sulphide ores also, and it is probable that the experimental lixiviation plant will be greatly enlarged. The Keystone has been a shipper since circa 1898, and is said to have been highly profitable to the former owners, Messrs. Finletter & Harvey. Production, 1899 to 1904, was 1,067 tons, netting $37,276.98. Ores smelted have given returns of 22% to 27% copper, and early in 1906 the property was shipping low-grade silicious ores, of 3% to 5% copper tenor, to the Old Dominion smelter, for convertor linings. Management is excellent, and property is considered highly promising.

KEYSTONE COPPER MINING CO. **NEW MEXICO.**

Office: Bloomsburg, Pa. Mine office: Tres Piedras, Taos Co., N. M. J. P. Rinker, superintendent. Lands, 18 claims, known as the Payroll mine, in the Bromide district, opened to depth of about 250′ and showing a 20′ vein of sulphide ore, said to assay 6% to 12% copper, with fair gold values. Has steam power and a 50-ton concentrator. Presumably idle.

KEYSTONE COPPER & GOLD MINING CO. **ARIZONA.**

Office: 502 Park Bldg., Pittsburg, Pa. Mine office: Wickenburg, Maricopa Co., Ariz. C. B. McLean, president; W. J. Strassburger, secretary and general manager; W. F. Wilson, treasurer. Organized 1900, under laws of Arizona, with capitalization $1,250,000, shares $10 par. Lands, 24 claims, in the Blue Tank and Black Rock districts, showing sulphide ore bodies. Idle for several years.

KEYSTONE COPPER SMELTER CO. **MEXICO.**

Office: 330 Drexel Bldg., Philadelphia, Pa. General Mexican office: Apartado 22, Guadalajara, Mexico. Mine office: Tapalpa, Jalisco, Mex. Robert P. Molten, president; Edward E. Cattel, vice-president and chairman of executive committee; Aubrey F. Lee, secretary; Daniel Lamont, Jr., treasurer; Theo. Breidenbach, general manager. Organized under laws of New Jersey, with capitalization $300,000, increased, July 6, 1905, to $500,000, shares $1 par. Has authorized an issue of $100,000 certificates of indebtedness, at 6% interest, redeemable December 10, 1908.

Lands, 5 groups including La Mexicana, La America and La Palma groups, also timber rights to circa 50,000 acres of adjoining lands. Principal development is on La Mexicana group, area 82 pertenencias, 15 miles west of Tapalpa, mine being developed by a 200-metre crosscut tunnel, cutting 4 veins, with circa one mile of underground openings. Veins are fissures in porphyry, averaging 5′ width, and carrying auriferous and argentiferous chalcopyrite, sphalerite and iron pyrites.

The property has steam and electric power and a 30-ton mill, with 2 crushers, 2 rolls and 3 tables. The smelter has a 75-ton reverberatory furnace, turning out matte of 30% to 48% copper tenor. It is planned to add a cyanide plant for treatment of ores rich in gold. The property employs about 100 men, and seems developing along sensible lines, and the management enjoys a good local standing.

KEYSTONE MINING & DEVELOPMENT CO. **COLORADO & WYOMING.**

Office: 839 Equitable Bldg., Denver, Colo., Mine offices: Downington, Carbon Co., Wyo., and Boulder, Boulder Co., Colo. Dr. E. T. Ettinger, president and general manager; Wm. R. Klein, secretary; G. C. Aschbach, treasurer; Foster Kearns, superintendent Wyoming mine; L. Hauselman, superintendent Colorado mine. Organized April 18, 1901, under laws of Wyoming, with capitalization $2,000,000, shares $1 par, as successor of Kearns Consolidated Copper Mines Co.

The Wyoming lands, area 206 acres, are on Beaver Creek, circa 12 miles south of Encampment, and the Downington townsite, 160 acres, patented. The Kearns mine is opened by a 600′ tunnel.

The Colorado properties, which carry gold only, include the Smoky Hill mine, area 20 acres, partly patented; the Dirigo mine, area 60 acres, patented, and the Norumbega mine, area 40 acres, all in Boulder county. Principal development seems to be on the Colorado gold properties.

KEY TO SUCCESS COPPER MINING, SMELTING & EXPLORATION CO. LTD., OF PIERRE, SOUTH DAKOTA. UTAH.

Office: 213 Providence Bldg., Duluth, Minn. A. R. Merritt, president; C. E. Mylen, vice-president; Geo. F. Davis, secretary; J. S. Lane, treasurer; preceding officers, H. Brown and John L. McGilvery, directors. Organized 1902, under laws of South Dakota, with capitalization $1,500,000, shares $1 par; issued, $825,000. Lands, 12 claims, area 240 acres, also a 40-acre millsite, in the Beaver Lake district of Beaver county, Utah, opened by shafts of 25′, 75′ and 105′, showing ore carrying 3% to 6% copper, with gold and silver values. Idle, but company plans resuming work, during 1906.

KEY WEST MINING CO. NEVADA.

Mine office: Bunkerville, Lincoln Co., Nev. S. W. Darling, superintendent, at last accounts. Ores carry nickel, copper and platinum. Has steam power. Presumably idle.

KHAYYAM COPPER CO. ALASKA.

Merged, circa 1904, in Omar Mining Co.

KIADEBEK MINE. RUSSIA.

Described under title Berg- und Hüttenwerke Kedabeg.

KILLINGDAL KOBBERVAERK. NORWAY.

Owned by Bede Metal & Chemical Co.

KIMBALL CREEK MINING CO. WASHINGTON.

Dead. Letters returned from all addresses.

KIN-E-CHY MINING & MILLING CO. ARIZONA.

Office: 1112 Majestic Bldg., Detroit, Michigan. Mine office: Willcox, Cochise Co., Ariz. Employs 8 men. J. George Zink, president; Geo. J. Robinson, vice-president; Fred P. Obenauer, secretary and treasurer; Gust. Becker, manager. Lands, 33 claims, area 660 acres, in 5 groups, in the Aravaipa district, showing several fair sized veins, carrying variable values in gold, silver, copper and lead. The copper group, of 14 claims, has a 7x14′ shaft 72′ deep, and a 150′ tunnel. The gold group, of 6 claims, shows a considerable body of low-grade gold ore. Equipment includes a small steam power mining plant, and a small stamp-mill, built 1903.

KING COPPER MINING CO. OF NEVADA. NEVADA.

Office: 431 Exchange Bldg., Boston, Mass. Letter returned unclaimed from former mine office, Lovelocks, Humboldt Co., Nev. T. H. Lowe, superintendent. Property was the Anderson mine, carrying auriferous and argentiferous copper ores, slightly developed.

KING EDWARD MINING CO. ONTARIO.

Office: care of Samuel Jeffery, secretary, Calumet, Mich. Henry Fliege, president, Paul P. Roehm, vice-president; W. J. Galbraith, treasurer; Capt. Wm. F. Ashton, superintendent. Organized 1904, under laws of Ontario, with capitalization $3,000,000, shares $10 par. Property is some distance

east of Sault Ste. Marie, in Algoma, Ontario, developed by a shallow shaft, said to show a 25′ vein of chalcopyrite, from which assays of 9% copper have been secured. Idle, since early in 1905.

KING GOLD & COPPER MINING CO. **WASHINGTON.**

Office: Davenport, Wash. Mine office: Springdale, Stevens Co., Wash. J. B. Tuttle, Sr., president and general manager; J. T. McAviney, vice-president; J. B. Tuttle, Jr., secretary and treasurer; preceding officers, A. M. Campbell and G. B. M. Seager, directors. Organized June, 1900, under laws of Washington, with capitalization $2,000,000, shares $1 par. Lands, 9 miles west of Springdale, known as the Edna-Gladiator, carry a contact vein between diorite and quartz, opened by a 370′ shaft, showing melaconite and chalcocite, of $10 to $35 value per ton, with silicious gangue. Equipment includes a 350-h. p. boiler, 10x11″ friction hoist, 8-drill air-compressor, power drills, steam pumps, electric light plant and various engine-houses, shaft-houses, bunk-houses and ore-bins. Suit brought by dissatisfied shareholders, alleging mismanagement, was dismissed September, 1905, the court holding that allegations were not proven.

KING GOLD & COPPER MINING & MILLING CO. **CALIFORNIA.**

Letter returned unclaimed from former office, 921-185 Dearborn St., Chicago, Ills. Company advertised to give an absolutely guaranteed investment, and was stated, in Volume V of the Copper Handbook, to be managed either by fools or rascals, which statement seems fully verified by the outcome.

KINGMAN MINE. **CALIFORNIA.**

Office and mine: care of Jas. McDonald, owner, Darwin, Inyo Co., Cal. Has a 3′ contact vein, between limestone and granite, carrying slightly auriferous and argentiferous cuprite, malachite and chalcopyrite.

KINGMAN SMELTING & REFINING CO. **ARIZONA.**

Office: Kingman, Mohave Co., Ariz. Organized, late in 1905, to build a custom smelter, at Kingman.

KING MINING CO. **WYOMING.**

Office: Fremont, Neb. Letter returned unclaimed from former mine office, Riverside, Carbon Co., Wyo. T. Carroll, president and general manager; J. O. Bell, secretary; J. A. Knowles, treasurer. Lands, sundry claims, on the south fork of the Grand Encampment river, slightly developed by a crosscut tunnel, showing auriferous copper ore, carrying values mainly in gold.

KING MINING CO., LTD. **BRITISH COLUMBIA.**

Reorganized, circa 1903, as Denoro Mines, Ltd.

KING PHILIP COPPER CO. **MICHIGAN.**

Office: 701-199 Washington St., Boston, Mass. Operating office: Houghton, Mich. Mine office: Winona, Houghton Co., Mich. Arthur G. Stanwood, president; Geo. P. Gardner, vice-president; preceding officers, Walter Hunnewell, Rufus R. Goodell, Chas. J. Paine, Jr., Nathaniel H. Stone and Nathaniel Thayer, directors; Edward B. O'Connor, secretary and treasurer; Dr. L. L. Hubbard, manager, Rex R. Seeber, superintendent. Organized November 13, 1905 under laws of Michigan, with capitalization

$2,500,000, $6 paid in. Is a close corporation, no stock having been sold publicly. One-half of the stock issue was given for lands, 35,000 shares going to St. Mary's Mineral Land Co., which also bought 20,000 shares for cash, at $6, securing control, with holdings of 55,000 shares, leaving 30,000 shares unissued. On March 1, 1906, the company had cash on hand, $75,778.58. City Trust Co., Boston, registrar.

Lands, 1,040 acres, in Houghton and Ontonagon counties, Michigan, main tract lying about 1 mile south of the Winona mine. The first shaft, 1,500′ from the northwest corner of the tract, struck quicksand at 32′, hence was changed to a drainage shaft, and a new shaft started, 75′ distant. It is planned to change this vertical temporary shaft into a permanent incline shaft, at a dip of circa 70°. Shaft, 14x25′, was bottomed in rock, May, 1906, at a depth of 50′. Equipment includes a 100-h. p. boiler and 6-drill Ingersoll-Sergeant air-compressor. New machinery ordered includes a 12x20″ hoist, with 5′ drum, good for 1,200′ depth, and a 15-drill air-compressor with 18x42″ cylinders. Buildings include a 24x36′ frame office, warehouse, 24x62′ bunk-house, 20x50′ cook-house, 15x24′ smithy, 28x40′ boiler and engine-house, and a 16x30′ change-house.

KING & QUEEN MINING CO. **MONTANA.**

Office: 1007 Bessemer Bldg., Pittsburg, Pa. Mine office: Superior, Missoula Co., Mont. Employs 6 men. Nelson Weddle, Jr., president; Chas. J. Rieger, vice-president; J. F. Hinckley, secretary; H. A. Spangler, treasurer; preceding officers, B. H. Howard, J. L. Armstrong, R. W. Judkins and Dr. Geo. T. McCullough, directors; T. E. Wood, superintendent. Organized March 22, 1905, under laws of Montana, with capitalization $1,000,000, shares $1 par. Lands, 15 claims, partly patented, area 188 acres, also a 20-acre millsite, all well timbered, in the Spring Gulch district, showing country rocks of limestone, quartzite and shale, with 5 contact veins between quartzite and limestone, of which 2, under development, have 8′ average width, and have given average assays of 6.5% copper, 16% lead and 16 oz. silver per ton, from malachite, chalcocite and chalcopyrite. Development is by a 300′ shaft and 1,200′ tunnel, estimated to show 4,000 tons of ore. Equipment includes an 80-h. p. boiler, 25-h. p. hoist, good for 800′ depth, and a duplex 6-drill air-compressor, also a sawmill of 6,000′ daily capacity, and several mine buildings. Property is 3½ miles from Northern Pacific Railroad. Was a small producer, for circa 10 years, before bought by present owners.

KING SOLOMON MINES. **BRITISH COLUMBIA.**

Office: care of J. S. H. Matson, Victoria, B. C. Mine office: Cowichan, Vancouver Island, B. C. Wm. Lewis, superintendent. Organized 1904, with capitalization $15,000, shares $1,500 par. Lands, 4 miles from the Esquimalt & Nanaimo Railroad, on Copper Mountain, in the Helmken district, include the King Solomon and Queen of Sheba claims. Shipped 56 tons of ore, to the Tyee smelter, which returned 8.93% copper.

KING SOLOMON MINING CO. **BRITISH COLUMBIA.**

Office: care of D. C. Corbin, owner, Spokane, Wash. Letter returned

unclaimed from former mine office, Greenwood, Boundary district, B. C. Lands are near the Montreal & Boston holdings of the Dominion Copper Co., Ltd. Mine produced, 1902, circa 700 tons of ore. Idle.

KING SOLOMON TUNNEL MINING CO. **COLORADO.**

Mine office: Frisco, Summit Co., Colo. James H. Myers, superintendent, at last accounts. Ores carry gold, silver, lead and copper. Presumably idle.

KISHORN MINE. **SCOTLAND.**

Office and mine: care of Mrs. M. M. H. Stewart, Kishorn, Loch Carron, Rosshire, Scotland. Property was worked about the close of the Eighteenth or opening of the Nineteenth Century, but has remained idle since, until reopened, 1904, when a force of about 80 men was worked on development, for a time.

KITANNING COPPER MINING CO. **WASHINGTON.**

Presumably dead. Letters returned from all former offices.

KITTICOOLA GOLD-COPPER MINE, LTD. **SOUTH AUSTRALIA.**

Office: care of T. S. Backhouse, Glenelg, South Australia. Mine office: Reedy Creek, South Australia. The property, sometimes known as the Tungkillo mine, opened 1845, lies 34 miles northeast of Adelaide, and is held under lease from the Australian Mining Co., since 1879. Ores are rich, but bunchy, and in early days averaged 22% copper. Has two main veins, one apparently worked out, and on Baker's lode has shafts of 240′ and 360′.

KITTILSLAND KOBBERVAERK. **NORWAY.**

Letter returned unclaimed by former owners, N. Kior & Co., Christiania, Norway. Mine was idle, at last accounts.

KJOLI MINES, LTD. **NORWAY.**

Offices: 4, Suffolk St., Pall Mall East, London, S. W., Eng. Mine office: Reitan, Aalen, Guldalen, Norway. Sir W. E. M. Tomlison, Bart., chairman; W. B. Pearson, secretary. Organized July 29, 1903, with capitalization £100,000, shares £1 par. Debentures, £40,000, at 6%. Property is the Kjöli group of mines, near Röros, claimed to have a 10-mile aerial tramway, and asserted to be working circa 300 men, at close of 1905.

BERGVERWALTUNG KLAUSEN. **AUSTRIA.**

Mine office: Klausen Pfunderberg, Tyrol, Austria.

GEWERKSCHAFT KLINGENTHAL-GRASLITZER KUPFERBERGBAU. **GERMANY.**

Mine office: Klingenthal, Saxony, Germany. Erhart August Schiedt, manager. Has a 100-metre main shaft, developing chalcopyrite, and employed about 100 men, at last accounts.

KLIPKOP (NAMAQUALAND) COPPER SYNDICATE, LTD. **CAPE COLONY.**

Voluntarily liquidated, 1904.

KNAPP MINING CO. **COLORADO.**

Mine office: Pearl, Larimer Co., Colo. Is controlled by the National Mining & Milling Co. Lands, 9 claims, area 80 acres, known as the Big Horn group, opened by shafts of 65′ and 85′, showing chalcopyrite and occasional bornite. Has a 25-h. p. steam hoist.

ores.

KOEI MINE.

Mine office: Tsunekanemaru-mura, Ashina-gori, Bing
old property, reopened 1893. Ore is chalcopyrite, associat
erite, iron pyrites and micaceous hematite, in a fissure ve
with gangue of talc and hornblende. Country rock is hor
Concentrated ore averages 13.4% copper and 4% silver. Pr
was 88,495 lbs. fine copper.

KOKOMO-PIONEER MINING & MILLING CO.

Letter returned unclaimed from former mine office, Dum

KOKUSEI MINE.

Mine office: Kawabe-mura, Shonan-gori, Mimasaka,
opened 1882. Ore is chalcopyrite, associated with iron pyrites
tities of sphalerite, ore occuring as lenses, largest 60′ in
clay gouge, in sandstone and clay-slate. Production, 1899,
fine copper.

KOMAKI MINE.

A very old mine, located in the provinces of Ugo and I
Annual production, according to latest returns secured,
1,000,000 lbs. fine copper, and considerable gold is secured as

KOOTENAI COPPER-GOLD MINING CO.

Office: 15 Exchange Pl., Jersey City, N. J. Incorpor
1902, under laws of New Jersey, with capitalization $500,
B. Gould, John R. Turner and Louis B. Dailey.

KOOTENAI COPPER MINING & SMELTING CO.

Letter returned unclaimed from former office, Spokane,
office: Port Hill, Kootenai Co., Idaho. Idle and presumably

KOPERMYN (TRANSVAAL), LTD.

Offices: 237, Finsbury Pavement House, London, E. C.,
Smith, secretary. Organized October 19, 1905, with capitaliz

KREMLIN MINING CO. **UTAH.**

Mine office: Bingham Canyon, Salt Lake Co., Utah. D. M. Houston, superintendent. Has a 300′ shaft, and was idle several years, owing to water, but has been drained through the main tunnel of the Bingham Consolidated. Is said to show a large body of concentrating ore, on the 300′ level.

KRUGER COPPER & SILVER MINING CO. **MEXICO.**

Office: 50 Congress St., Boston, Mass. Mine office: Cusihuiriáchic, Chihuahua, Mex. Edward Glines, president; Philip A. Warner, vice-president and consulting engineer; James P. Hughes, secretary; Edgar M. Parker, treasurer; Geo. W. Boyce, general manager. Organized August, 1903, under laws of South Dakota, with capitalization $500,000, shares $5 par. Lands, 42 pertenencias, area 140 acres, having an old 80′ shaft, said to show copper carbonates and chalcocite, with associated gold and silver values. Sunk a new 100′ shaft, 1905, without encouraging results. Local tradition says mine has produced some rich ore. Idle.

GEWERKSCHAFT KUHLENBERGER ZUG. **GERMANY.**

Office: Düsseldorf, Germany. Property is sundry mines in the province of Westfalen, carrying ores of silver, lead, copper, zinc and iron. Employed circa 100 men, at last accounts.

KUNE MINE. **JAPAN.**

Owned by Furukawa Mining Co.

GEWERKSCHAFT KUPFERBERG. **GERMANY.**

Mine office: Kupferberg, Bavaria, Germany. Ferdinand Kröner, agent.

KUPFERKIESBERGBAU KUPFERPLATTE. **AUSTRIA.**

Mine office: Kitzbühel, Tyrol, Austria. Ore is chalcopyrite, with quartz gangue, occurring as horizontal beds in Silurian slates. Is an old mine and a small producer.

KURILLA MINE. **AUSTRALIA.**

Owned by Wallaroo & Moonta Mining & Smelting Co., Ltd.

KUROTAKI MINE. **JAPAN.**

Mine office: Motokawa-mura, Tosa-gori, Tosa, Japan. Is a short distance only from the famous Besshi mine. Ore is chalcopyrite, first quality averaging 10% and second grade 2% to 4% copper. Beds are much contorted, principal widths and values being found in the saddles and troughs, which average about 10′ thickness. Production, 1900, was 151,890 lbs. fine copper.

KURTZ-CHATTERTON COPPER MINING CO. **WYOMING.**

Succeeded by Chatterton Mining Co.

KUSAKURA MINES. **JAPAN.**

Owned by Furukawa Mining Co.

KVANANGENS KOBBERGRUBER. **NORWAY.**

Described under title Altens Kobbergruber.

LABOR CO-OPERATIVE GOLD, SILVER & COPPER MINING CO. **BRITISH COLUMBIA.**

Office: 99 Washington St., Chicago, Ills. Mine office: Golden, Koot-

enay district, B. C. Philip Chesley, president; Rev. C. E. Nylin, secretary and treasurer. Organized under laws of British Columbia, with capitalization $150,000, shares 10 cents par. Is a deliberate swindle, operated under the garb of religion, by Parson Nylin, a Baptist preacher, who is a disgrace to the cloth, with the aid of Chesley and other accomplices.

LA CANANEAS COPPER CO. **MEXICO.**

Office: care of Ehud N. Darling, secretary, 10 Wall St., New York. Mine office: La Cananea, Sonora, Mex. Fred A. Trittle, president. Organized under laws of Arizona, with capitalization $5,000,000 shares $5 par. Was promoted by Henry B. Clifford & Co., but management said to be now in the hands of P. Sandoval & Co., substantial bankers of Nogales, Arizona, and Nogales, Sonora, Mexico. Lands, 230 acres, including La Libertad and El Ultimatum groups, near the Greene Consolidated, having a 150′ shaft, with circa 300′ of workings, said to show a 15′ vein of ore similar to the Puertecitos ores of the Greene Consolidated. Property considered promising, but presumably idle.

LAC LA BELLE MINING CO. **MICHIGAN.**

Sold lands, 1905, for $250,000, to Manitou Mining Co.

LA CLEDE GOLD & COPPER MINING CO. **COLORADO.**

Office: Kittredge Bldg., Denver, Colo. Letter returned unclaimed from former mine office, Ohio, Clear Creek Co., Colo. J. H. Holloway, president; I. E. Black, secretary. Organized November, 1903, with capitalization $1,000,000, shares $1 par. Lands, 4 claims, area 80 acres, also a $20,000 3-year bond and lease on the Ohio mine, opened by a 300′ shaft and 1,200′ tunnel and having steam power. The Ohio has produced about $250,000 worth of ore, but was flooded by cutting an underground watercourse. Company also supposed to have sundry claims near Goldfield, Nevada.

LA COBRIZA MINING CO. **MEXICO.**

Office: care of C. C. Stewart, El Paso, Texas. Operating office: Apartado 25, Magdalena, Sonora, Mex. Mine office: Campo Cobriza, Puerto, Altar, Sonora, Mexico. Employs 25 men. Fred C. Emery, president and general manager; W. T. Stewart, vice-president and superintendent; A. R. Taylor, treasurer. Organized June 5, 1906, under laws of Arizona, with capitalization $250,000, shares $1 par. Lands, 21 pertenencias, area 17 acres, in the Magdalena district, 16 miles west of Puerto, showing limestone and granite-porphyry country rocks, carrying several contact veins between limestone and porphyry, with vertical dip. One vein, under development, is said to average 40′ width, with a 3,000′ outcroup, giving average assays of 15% copper, 10 oz. silver and $5 gold per ton, from melaconite, malachite and chalcopyrite. Has shafts of 85′ and 100′, and plans pushing development and building a 250-ton smelter during latter half of 1906. Development, while promising, is entirely inadquate to feeding a smelter.

LA CORONA COPPER MINING CO., LTD. **SPAIN.**

Offices: Clock House, Arundel St., Strand, W. C., Eng. Edward E. Fernandez, chairman; Harold Cossins, secretary; J. W. Richmond Lee, general manager; John E. Marshall Hall, assistant engineer. Organized

October 21, 1905, with capitalization £20,000, shares £1 par, in 4,000 ordinary and 16,000 deferred shares; issued, £16,500. Lands are 3 mines, known as Corona I, Corona II and Los Azores, in the district of Fuencaliente, Ciudad Real, Spain.

LADD METALS CO. **IDAHO.**

Office: Canterbury Bldg., Portland, Ore. Mine offices: Mineral, Washington Co., Idaho, and Landore, Washington Co., Idaho. Chas. E. Ladd, president; Samuel Peacock, vice-president and general manager; John Snow, secretary and treasurer; Geo. D. Rich, general superintendent; John Williams, mine superintendent.

Lands are in 2 groups, both in the Seven Devils district. One group of 4 claims, at Mineral, near Weiser, bought of the Consolidated Copper Co., is shipping some ore, averaging 5% copper and up to 350 oz. silver per ton. The mining property at Landore has shipped a little ore, averaging 35% copper, and ore of much lower grade has been smelted, on the ground.

Company has smelters at both Mineral and Landore. The Mineral smelter has a small water-jacket blast-furnace, burning coke. The smelter at Landore, of 60 tons daily capacity, has a 50-ton combination reverberatory and water-jacket blast-furnace, former burning wood and latter burning coke. This anomalous furnace was devised by a former superintendent, on a novel and absolutely unsuccessful plan, combining in a double stack a reverberatory and a blast-furnace, with a downward blast and a moist updraft, charging being in both furnaces, and between the two. Fuel was to have been furnished by a gas-producer consuming wet, rotten, white fir wood. The theory and practice did not correlate, hence a new superintendent was secured and the plant remodeled along more usual lines.

Smelters were closed down November, 1905, on account of poor transportation facilities, which rendered it difficult to secure flux and fuel. It was planned, however, to resume work in 1906. Property, while poorly located as to facilities for transport, is considered promising.

LA DEMOCRATA MINING CO. **MEXICO.**

Office: 17 East 4th st., Cincinnati, Ohio. Organized 1905, under laws of Arizona, with capitalization $50,000, shares $10 par. Apparently bears some relation to the Democrata Cananea Sonora company.

LA DICHA MINING & SMELTING CO. OF MEXICO. **MEXICO.**

Is the Mexican incorporation of the Mitchell Mining Co.

LA DURA MILL & MINING CO. **MEXICO.**

Mine office: La Dura, Sonora, Mexico. Property is on the Yaqui river, in the Sahuaripa district of Sonora. Made 150 metric tons of copper matte in 1902, and 72 metric tons in 1903. It is said that the company may be consolidated with the Bufa Mining, Milling & Smelting Co., which apparently is under the same management.

LA DURA MINING CO. **MEXICO.**

Mine office: care of Hartmann & Groff, managers, Torres, Sonora, Mex. Ores carry gold, silver, copper and lead. Has steam power and turns out product as silver-lead-copper concentrates, when working.

LADY CHELAN COPPER CO. **WASHINGTON.**

Office: 234 Hyde Blk., Spokane, Wash. Presumably moribund.

LADY ELGIN COPPER MINING CO. **MAINE.**

Had a mine at Blue Hill, Hancock county, Maine, circa 1880. Presumably dead.

LADY HELEN COPPER MINING CO. **ARIZONA.**

Letter returned unclaimed from former mine office, Pima, Graham Co., Ariz. A. J. Halter, president. Organized under laws of New Jersey, with capitalization $1,000,000, shares $1 par, as successor of International Exploration & Investment Co. Lands, 100 acres, in the Clark district of Graham county.

LADY POND MINE. **NEWFOUNDLAND.**

An idle property at Lady Pond, Newfoundland, last worked, circa 1900, by Newfoundland Copper Co. Now owned by Carmen Copper Mines, Ltd.

LADYSMITH COPPER MINING CO. **MONTANA.**

Office: 259 La Salle St., Chicago, Ills. Mine office: Elliston, Powell Co., Mont. Arthur J. Bamford, president; V. W. Hemala, secretary; G. F. Newberg, treasurer. Organized 1905, under laws of South Dakota, with capitalization $400,000. Lands, 4 claims, 12 miles from Elliston, well timbered and watered. Development is by two 110′ shafts, said to show ore averaging 22.5% copper. Company alleged, in its prospectus, that dividends should be paid during 1906, but of course cannot pay same from profits of operation.

NUEVA SOCIEDAD PROPRIETARIA LA ESTRELLA. **SPAIN.**

Office: Granada, Spain. Property includes El Ensueño and La Jerezana mines, under option or lease to the Société Anonyme La Estrella, of Paris.

SOCIÉTÉ ANONYME LA ESTRELLA. **SPAIN.**

Office: 161, Boulevard Haussmann, Paris, France. Mine office: Los Martires, Granada, Spain. Capitalization, 200,000 francs. Don Huberto Meersmans, general manager; Don Antonio Melián, superintendent. Property includes La Jerezana, El Ensueño and other mines of copper, at Los Martires, termino del Boza, Granada, also an argentiferous copper group at Alpujarra, Granada. La Jerezana and adjoining mines were undergoing development, at last accounts.

LAFAYETTE MINING CO. **MICHIGAN.**

Wound up, 1906, and a dividend of $2.42 per share paid stockholders.

LA FLORENCIA GOLD & COPPER CO. **MEXICO.**

Office: 30 South Ninth St., Richmond, Va. Mine office: Cos, Sonora, Mex. D. A. Ainslie, president; R. F. Hudson, secretary; Tom L. West, general manager. Organized 1902, under laws of West Virginia, with capitalization $1,000,000, shares $1 par. Lands, 134 pertenencias, area circa 330 acres, 25 miles from nearest railroad, showing a wide mineralized belt with heavy iron capping, traceable 2 miles. Main shaft, 250′, with a 50′ crosscut in ore assaying 5% to 9% copper, with fair gold and silver values. Property considered valuable, but company apparently moribund.

LA FLORIDA MINING, MILLING & DEVELOPING CO. **MEXICO.**

Letter returned unclaimed from former office, Naco, Ariz. Moribund.

LA FORTUNA MINING CO. **MEXICO.**

Office: 416-27 William St., New York. Mine office: Ahualulco, Jalisco, Mexico. W. B. Stewart, president; Frank E. Lloyd, manager. Lands, 40 pertenencias, 5 miles northwest of Ahualulco, showing a 5′ to 20′ vein, carrying auriferous and argentiferous copper and lead ores, with quartz gangue. Is opened by tunnels, with about one-half mile of workings, showing circa 10,000 tons of ore. Has a small mill and produced circa 30 tons of ore daily, at last accounts.

LA FORTUNA MINING CO., S. A. **MEXICO.**

Is the Mexican incorporation of the Fortuna Mining Co.

LA FRANCE COPPER CO. **MONTANA.**

Office: 42 Broadway, New York. Mine office: Butte, Silver Bow Co., Mont. Works office: Basin, Jefferson Co., Mont. F. August Heinze, president; Albert Frank, superintendent; W. A. Kidney, mill superintendent; Organized April, 1905, under laws of New York, with capitalization $7,000,000, shares $25 par, in $1,000,000 preferred shares at 6%, and $6,000,000 common shares. Bonds, $2,000,000 authorized, at 6%.

Lands are the Lexington mine, 8 claims, area 32 acres, held under a $250,000 bond and lease from the French owners, in the name of Louis Girard, assigned to La France Copper Co. The Lexington has a 3-compartment main shaft, of 1,450′ depth, well timbered and ventilated, and connected on the 600′ level with the Alice mine, with several miles of workings, but having 950′ of water in the bottom, at the end of 1905, which it was planned to fork out. The mine was worked many years ago for gold and silver values, but below the 1,400′ level has a 30′ vein, with granitic gangue, carrying stringers of sulphide ore assaying 3% to 4% copper, and is said also to have a vein of 14′ average width, giving average returns of 2.75% copper, $4 silver and $5 gold per ton, with considerable zinc and a little lead. Equipment includes a 15x30″ Ottumwa hoist, raising a single-deck cage, to be replaced, 1906, by a 20x60″ Allis-Chalmers hoist raising two double-deck cages. A 50-drill air-compressor is being installed, and the mine has two electric pumps. The mine has an old mill, idle since 1893, with circa 100,000 tons of auriferous tailings, which probably could be cyanided profitably.

The reduction plant is the old Basin & Bay State concentrator, at Basin, supposedly held under a $600,000 bond and lease, The mill has 2 crushers, 8 sets of rolls, 4 Huntington mills, 90 Hartz jigs and 60 Wilfley tables. In April, 1906, the Lexington was producing circa 300 tons of ore daily, of which 125 tons of zinciferous ore were being sent to the works of the Montana Zinc Co., and 175 tons were going to the mill at Basin. The property has an aggressive and capable management, and is considered promising.

LAKE COPPER CO. **MICHIGAN.**

Office; Houghton, Mich. Mine office: Greenland, Ontonagon Co., Mich. Reginald C. Pryor, president; Wm. D. Calverley, secretary; preced-

ing officers, J. H. Rice, R. M. Edwards, B. F. Chynoweth and Linus Stannard, directors. Organized November 28, 1905, under laws of Michigan, with capitalization $2,500,000 shares $25 par. Of the capital stock, 55,000 shares were given the owners of the Belt lands, and 15,000 shares were sold, at $3, leaving 30,000 shares in the treasury and giving a cash working fund of $45,000. Lands, 740 acres, adjoining the Adventure, and carrying the strike of the Evergreen belt for one mile, on which considerable diamond drilling has been done. Property is the Belt mine, first opened 1848, and taken over, 1882, by the Belt Mines Co., Ltd., which corporation, by incompetence and bad management, sunk about £250,000 in 3 years, without securing as much as a half-mile of underground openings. Some exploratory work was done, 1901, under the management of Nathan F. Leopold, with Capt. Wm. A. Dunn in charge.

Operations by present company have been confined mainly to the Knowlton and Butler lodes, with a little work on a lode formerly supposed to be the Evergreen. There are shafts of 170′ and 300′ on the Knowlton lode, and the latter shaft is being deepened to 600′, and is sinking through decidedly promising ground. There also is a 90′ shaft on the Tresidder lode, circa 1,000′ east of the Knowlton bed, which was sunk circa 1865, and is said to have paid for its sinking from the copper taken out.

Equipment includes a 12x15″ duplex hoist and a 6-drill air-compressor. Management is good, and the plan of development is eminently sound, this calling for the expenditure of every dollar available, underground, rather than upon extensive surface improvements, which can come later, if the showing made in the mine warrants such outlay.

LAKE COPPER PROPRIETARY CO., LTD. **SWEDEN.**

Office: 40, Queen Victoria St., London, E. C., Eng. Organized March 10, 1906, with capitalization £300,000, in 298,000 ordinary shares of £1 par, and 40,000 deferred shares of 1s. par. Was formed to acquire control of the Lake Copper Syndicate Aktiebolag, a Swedish corporation controlling sundry mining lands in Sweden.

LAKE GEORGE MINES, LTD. **AUSTRALIA.**

Reorganized, 1904, as Lake George Successors, Ltd.

LAKE GEORGE SUCCESSORS, LTD. **AUSTRALIA.**

Offices: 10, Walbrook, London, E. C., Eng. Mine office: Bungendore, N. S. W., Australia. A. J. Marks, chairman; N. R. G. Rivington, mine manager; H. R. Westall, secretary. Organized June 8, 1904, as a second reconstruction of the Lake George Mines, Ltd., with capitalization £10,000, shares 1s. par; issued, £2,940. Lands, 172 acres, freehold, at Captains Flat, Lake George, N. S. W. Has a cyanide plant and small smelter, with reserves of about 11,000 tons of ore, said to be unpayable. Mine was opened 1882, and has a depth of about 600.′ Main vein is 22′ to 30′ wide, and very persistent, having a meridional strike and vertical dip, in a country-rock of Silurian slates. Ore occurs as replacements along fault-lines, and is a compact, fine-grained mixture of chalcopyrite, sphalerite, galena and iron pyrites, in an aluminous quartzose gangue. Ore averages about 1.5% cop-

per, with small gold and silver values, and is very refractory. Has four 60-ton water-jacket blast-furnaces, using 50% flux and 50% fuel charges, and also has tried pyritic smelting. Annual production formerly was about 500 tons of fine copper, sold as matte carrying 30% to 35% copper and about 200 oz. silver and 5 oz. gold per ton of blister copper. Present operations are confined to efforts to secure sundry monies, paid into court by the old company.

LAKE HURON COPPER SYNDICATE, LTD. **ONTARIO.**

Voluntarily wound up, February, 1901.

LAKE SHORE MINING CO. **MICHIGAN.**

Office: care of W. H. Garlick, president, Marquette, Mich. Mine office: Green, Ontonagon Co., Mich. Organized under laws of Michigan, with capitalization $500,000, shares $25 par. Lands, 773 acres, in 51-44, Ontonagon county, Michigan, carrying 3 copper-bearing veins, of 5', 5', and 12' width, showing oxide ore and chalcocite giving assays of 1.5% copper, 0.5 oz. silver and 40 cents to 80 cents gold per ton.

LAKESIDE GOLD-COPPER MINING CO. **WASHINGTON.**

Letter returned unclaimed from former office, Spokane, Wash. Mine office: Index, Snohomish Co., Wash. Geo. W. Weatherbee, president; A. L. Sweetser, secretary and treasurer; E. W. Berry, general manager. Capitalization $1,000,000, shares $1 par. Lands, 7 claims, in the Index district. Idle.

LAKE SUPERIOR & ARIZONA MINING CO. **ARIZONA.**

Title changed, 1904, to Lake Superior & Arizona Mining & Smelting Co.

LAKE SUPERIOR & ARIZONA MINING & SMELTING CO. **ARIZONA.**

Office: Calumet, Mich. Mine office: Florence, Pinal Co., Ariz. John D. Cuddihy, president; Dr. W. A. Holt, vice-president; Johnson Vivian, Jr., second vice-president; Wm. B. Anderson, treasurer; A. E. Petermann, secretary; J. T. Reeder, assistant secretary; preceding officers, Wm. Thielman, Angus W. Kerr, Edward Ulseth, Henry L. Baer and Thos. Maslin, directors; Alfred C. Sieboth, superintendent; Dugald Stewart, clerk; Henry Richardson, engineer. Organized Sept. 30, 1902, under laws of Arizona, with capitalization $200,000, shares $1 par, as the Lake Superior & Arizona Mining Co., and reorganized, 1904, under present title, with increased capitalization. Levied a $1 assessment January, 1906, payable in installments, on the outstanding stock issue of 83,000 shares.

Lands, 110 acres, owned in fee, in the Pioneer district, known formerly as the Golden Eagle and worked for gold by the Gem Gold Mining Co., which went out of business, 1885, after paying considerable dividends. Litigation over titles was settled favorably to company, April, 1906. Property shows many shallow shafts and short tunnels, opened in a random manner, from which former owners extracted rich surface ores. The property shows 3 veins, of which 2 are under development, these being contact veins between quartzite and limestone, and averaging circa 6' width. The main vein, 6' to 7' wide, has a quartzite foot and limestone hanging wall, with dip of circa 35°, carrying auriferous and argentiferous copper ores, and showing a little free gold. Ores are mainly silicious oxides and carbonates, associated

with iron and manganese, and valuable for fluxing the base ores likely to be opened at greater depth. Shipments of 13 carloads, made 1905, from the Anderson tunnel, gave returns of 31.6% copper, 2.2 oz. silver and $2.67 gold per ton, giving net proceeds of $24,649.81.

Development is by one shaft and 4 tunnels. The vertical Vivian shaft, of 279′ depth, sunk in low ground, cut diagonally through about 30′ of ore. The Holt tunnel, of circa 500′ length, has a blind shaft, known as the Holt shaft, starting 215′ below surface and bottomed 675′ below the outcrop, which connects with the Carlton tunnel, of circa 250′ length, driven about 100′ below the Holt tunnel. The mine had 9,497′ of openings, at end of 1905, not including the old workings of former owners. The ground is soft, as a rule, requiring heavy timbering.

Equipment includes a good steam plant with a 175-h. p. water-tube boiler and a 16-drill Rand two-stage air-compressor having 14x24″ steam cylinders and air cylinders of 13x16″ and 24x16″. Buildings include a power-house, smithy, bunk-houses, etc., and an office and dwelling at Florence, 18 miles from the mine.

Shareholders of the Lake Superior & Arizona Mining & Smelting Co. have organized the Arizona Midland Railroad Co., capitalization $500,000, shares $1 par, to build a 25-mile railway between the mine, at Superior, and the Gila Valley, Globe & Northern railway, at Florence, the capitalization being for the estimated cost of the line. The company's plans call for the building of a smelter, at Florence, on the bank of the Gila river, where there is a good site and never-failing water supply. The company is expending about $100,000 yearly, and is opening a promising mine, but the property cannot be placed on a profitable productive basis until rail connections are secured.

LAKE SUPERIOR & BISBEE DEVELOPMENT CO. **ARIZONA.**

Office: Calumet, Mich. Mine office: Bisbee, Cochise Co., Ariz. Idle.

LAKE SUPERIOR CONCENTRATING CO. **MICHIGAN.**

Voluntarily wound up, 1905.

LAKE SUPERIOR COPPER & ZINC CO. **ONTARIO.**

Letter returned unclaimed from former office, 20 Broad St., New York.

LAKE SUPERIOR GOLD MINING & MILLING CO. **MEXICO.**

Office: Marquette, Mich. Letter returned unclaimed from former mine office, La Cananea, Sonora, Mex. F. H. Begole, treasurer. Capitalization $3,500,000, shares $5 par. Lands first held, 1,200 acres, near Magdalena, Sonora, Mexico, were abandoned, and operations transferred to a group of copper claims, area 900 acres, lying in the Cananea Mountains, Sonora.

LAKE SUPERIOR MINE. **MICHIGAN.**

Lands, 640 acres, in Sections 13 and 14, Town 50 N., Range 39 W., Ontonagon county, Michigan, carrying the northeasterly continuation of the parallel cupriferous beds of the Evergreen belt opened in the Mass and Adventure mines. Long idle.

LAKE SUPERIOR & PITTSBURG DEVELOPMENT CO. **ARIZONA.**

Succeeded, June 1, 1904, by Lake Superior & Pittsburg Mining Co.

LAKE SUPERIOR & PITTSBURG MINING CO. **ARIZONA.**

Office: Calumet, Mich. Mine office: Bisbee, Cochise Co., Ariz. Employs 275 men. Chas. Briggs, president; James Hoatson, vice-president; Thos. Hoatson, second vice-president; Louis W. Powell, third vice-president and general manager; Peter Ruppe, treasurer; Gordon R. Campbell, secretary; preceding officers, Thos. F. Cole, Chester A. Congdon, Charles d'Autremont, Jr., and Geo. E. Tener, directors; James E. Fisher, assistant secretary; Henry B. Paull, auditor; E. E. Whiteley, engineer; Frank Juleff, mine foreman. Organized April, 1904, under laws of Minnesota, as successor of Lake Superior & Pittsburg Development Co., with capitalization $3,000,000, shares $10 par; issued, $2,500,000, fully paid. Merchants & Miners Bank, Calumet, Mich., registrar. Annual meeting, second Monday in April. Ended 1905 with cash assets of $382,870.82, and liabilities of $584,807.24, giving a balance of liabilities of $201,936.42.

Lands, 44 claims, area 629 acres, patented, and owned in fee, with titles perfected. The mine has 2 shafts, and at hird may be sunk later, on the southeastern part of the company's extensive tract. The principal opening is the Cole shaft, formerly known as No. 2. This was sunk nearly 1,000′ by former owners, and has been straightened, retimbered and cut down from 2 small compartments to 4 large compartments of full working size, 8x24′ outside of timbers, the work of remodeling having been started simultaneously on 10 levels, and performed in record-breaking time. The shaft was 1,227′ deep at the end of 1905, with drifting begun on the 1,200′ level. It will be sunk to 1,500′ depth, and has opened drifts on the 800′, 900′, 1,000′ and 1,100′ levels, with drifting begun on the 1,200′ level, in May, 1906, with the shaft approaching the 1,300′ station. This shaft is connected with No. 3 shaft, on the Uncle Sam claim, some distance southward. The Cole shaft has Prescott and Cameron station pumps, caring for a present flow of 225 gallons per minute, and capable of much heavier duty. It is obvious that the Briggs shaft of the Calumet & Pittsburg is caring for considerable part of the normal water supply of the Cole shaft. Large ore bodies have been opened on the 900′, 1,000′ and 1,100′ levels, notably the latter. The ores are similar in occurrence and nature to those of the Copper Queen and Calumet & Arizona, of which the L. S. & P. ore bodies are the southerly continuation, and the 1,100′ level shows long stopes of ore ranging in copper tenor from 7% to 30%, with small gold and silver values. Development work was retarded, during 1904-1905, by the remodeling of the shaft, but is being pushed vigorously, since that necessary work was completed.

No. 3 shaft, on the Uncle Sam claim, is 1,000′ deep, and will be kept in abeyance for the present. No. 1 was an old shaft of the former owners, of small size and shallow depth, and doubtless never will be used by the present management. The production of the Pittsburg & Duluth mine is through the Cole shaft, by a long drift on the 1,000′ level, penetrating Pitts-

burgh & Duluth territory, and eventually connecting with the Oliver shaft of the Calumet & Arizona mine.

The main mining plant is at the Cole shaft, and includes boilers of 800 aggregate horse-power, burning petroleum, a 16-drill air-compressor and single-drum hoists with 12x14″ and 12x36″ cylinders. The Cole shaft is to have a Nordberg hoist, similar to that at the Junction mine, with 18x42″ quadruple cylinders, and double drums, capable of raising 12-ton loads from a half-mile depth, and is to hoist triple-deck cages carrying 3-ton cars, operating in balance, or singly, as desired. This hoist will have no superior in Arizona, and few anywhere. Surface improvements include a timber-mill, smithy, office, changing-house, etc.

Production was begun October, 1905, ores going to the Calumet & Arizona smelter, at Douglas, where the use of a single furnace is shared with the Pittsburg & Duluth, the latter furnishing about one-third of the joint tonnage. At the end of 1905 the Lake Superior & Pittsburg was shipping circa 1,000 tons of ore weekly, securing therefrom average returns of better than 8% copper and 45 cents per ton gold and silver. Production, 1905, was 1,721,295 lbs. fine copper and $5,418.23 gold and silver, the ores smelted giving returns of 8.5% copper.

The management is the same as that of the Calumet & Arizona, which has made a phenomenal success in Arizona copper mining, and is capable at all points. The Lake Superior & Pittsburg Mining Co. is to be merged, during 1906, by means of a holding company, known as the Superior & Pittsburg, with the Pittsburg & Duluth, Calumet & Pittsburg and Junction mining companies, and the company so formed must make a very profitable copper producer of great size, in the course of a few years.

LAKE SUPERIOR POWER CO. **ONTARIO.**

Office: Sault Ste. Marie, Ont. Mine office: Gertrude Mine, Algoma, Ontario. C. D. Warren, president; W. N. Sawyer, general manager; A. B. Willmott, superintendent. Lands, 7 claims, area circa 2,000 acres, including the Gertrude and Elsie nickel-copper mines, in Creighton township, showing 4 contact veins, of which 2, slightly developed, carry cupriferous and nickeliferous pyrrhotite, returning an average of 0.5% copper and 3% nickel. Has shafts of 60′ and 120′, with circa 1,000′ of underground openings, estimated by previous management to show 500,000 tons of ore, with 50,000 tons blocked out for stoping, which obviously is an overestimate. Has a steam plant with tubular boilers, 2 hoists and a 12-drill air-compressor.

Smelter, ½ mile from the mine, and connected therewith by the Manitoulin & North Shore railway, has a 100-ton Herreshoff water-jacket blast-furnace, making, when in operation, matte with a combined copper and nickel tenor of 25%. Idle since circa 1904.

LAKE SUPERIOR SMELTING CO. **MICHIGAN.**

Office: 303-199 Washington St., Boston, Mass. Operating office: Postoffice Block, Houghton, Mich. Works office: Dollar Bay, Houghton Co., Mich. Norman W. Haire, manager; Harry B. Conant, superintendent;

J. C. Dunstan, clerk; E. Kneeland, chemist; H. M. Germberger, assistant chemist. Capitalization $1,200,000, shares $25 par. Stock is owned jointly by the Detroit & Lake Superior Copper Co., of Waterbury, Conn., and the Tamarack-Osceola Copper Mfg. Co.

Plant includes smelters at Hancock and Dollar Bay, Houghton county, Michigan. The Hancock plant is the oldest in the Lake Superior district, and is worked intermittently, being idle since March, 1905. The Dollar Bay plant is closely connected with the works of the Tamarack-Osceola Copper Manufacturing Co., and employs circa 300 men. The Dollar Bay works have 11 reverberatory furnaces, four of 17x30′ size and seven of 11x16′ size, each. One of the larger furnaces has a mechanical ladling and casting device, and the three other larger furnaces are to have similar equipments, which will enable the four large furnaces to do all smelting for the plant, putting the seven smaller furnaces out of commission. The mechanical ladling and casting device has a 1,100-lb. ladle and a casting machine with moulds linked into an endless belt, dumping over sprockets into cooling tanks, whence the ingots are removed mechanically by cleat elevators, which deliver the ingots to inspection and loading platforms. On the return of the moulds, while inverted, they pass over a rosin fire, which coats them with lampblack, to prevent sticking. In a test run a single machine cast 34,700 pounds of ingots in 58 minutes.

MINA LA LAPILLA. **SPAIN.**

Mine office: Alosno, Huelva, Spain. Wm. Guthrie Bowie, manager. Is a group of government concessions, adjoining the Tharsis mine. Ores occur as a very wide lense, and range from 2.5% to 8% copper, and 47% to 50% sulphur. Was formerly operated by pillar-and-stall, leaving large quantities of ore in floors and pillars. Has about 1,200,000 tons of ore available underground, and much more if worked open-cast. Output is lessened because of poor ventilation. Property shows enormous quantities of scoria, left from smelting operations of the Romans. Is well equipped with machinery.

LA MANGIARDE, LTD. **FRANCE.**

Offices: 5, Clements Inn, Strand, London, W. C., Eng. Letter returned unclaimed from alleged mine office, La Tour-sur-Tinée, Alpes Maritime, France. T. Cowperthewaite, chairman. Organized October 30, 1903, with capitalization £4,000, shares £1 par; issued, £3,000. Lands, sundry coal mines and undeveloped mineral lands carrying indications of copper, in the neighborhood of Nice.

SUCESION C. J. LAMBERT. **CHILE.**

Mine office: Brillador, La Serena, Coquimbo, Chile. Operates La Compañía mine, opened 1850, making 500 to 700 tons fine copper yearly. Also owns Las Bronces mine, 550′ deep, opened 1840, and has an extensive smelting plant, employing circa 500 men, at last accounts.

ERZBERGWERK LAMPERTUS. **GERMANY.**

Mine office: Hohenstein-Ernsthal, Saxony, Germany. Friederich Wilhelm Feltzner, president. Property carries auriferous and argentiferous arsenical ores of copper. Employed 12 men, at last accounts.

LA NATIVIDAD MINING CO. **MEXICO.**

Letters returned unclaimed from former office and mine office. Was a swindle. Described in Volume V. Succeeded by Mexican Mining Syndicate.

LANCASTER GOLD & COPPER MINING CO.

Office: care of David S. Johns, Keystone Hotel, Lancaster, Pa.

LANCELOT FREEHOLD TIN & COPPER MINES, LTD. **AUSTRALIA.**

Offices: 1, Bucklersbury, London, E. C., Eng. Mine office: Herberton, Queensland, Australia. F. E. Clotten, chairman and managing director; G. A. Waller, mine manager; F. J. Duck, secretary. Organized May 27, 1903, as a reorganization of the Lancelot Tin Mining Co., Ltd., with capitalization £120,000, shares £1 par; issued, £97,641. Debentures, £20,000 authorized, £19,250 issued, at 10%. Lands, 60 acres freehold and 160 acres leasehold, carrying ores of copper, tin, bismuth and wolfram, opened by a 327′ main shaft and a 150′ tunnel. Has a concentrating mill, and, at last accounts, was a small producer of tin and bismuth.

LANCONE MINE. **CORSICA**

Owned by Consolidated Copper Co., Ltd.

COMPAÑIA MINERA LA PAZ. **MEXICO.**

Mine office: Cuatro Cienegas, Coahuila, Mexico. Has silver-copper ores.

LA PLATA CONSOLIDATED MINING CO. **UTAH.**

Letters returned unclaimed from former office, 310 Converse Bldg., Boston. Had lands near Ogden, Weber county, Utah. At last accounts officers were being sued by shareholders for an accounting.

LARDEAU-DUNCAN MINES, LTD. **BRITISH COLUMBIA.**

Office: 5 Wolverton Blk., Spokane, Wash. John MacKenzie, president; A. H. Wheatley, secretary and treasurer. Organized under laws of British Columbia, with capitalization $150,000, shares 10 cents par. Lands, 3 claims, area 150 acres, with 4 adjoining claims under option, on Cariboo Creek, in the Lardeau-Duncan district of British Columbia, showing a quartz vein carrying gold, copper, silver and zinc, with a strong gossan capping carrying a little azurite. Development is by open-cut and a short tunnel, showing ores giving average assay values of $19 per ton, mainly in gold and copper.

LA RITA DEVELOPMENT CO. **ARIZONA.**

Office: Tombstone, Ariz. Mine office: Fairbank, Cochise Co., Ariz. James Herron, president; Frank Hare and D. L. Cunningham, directors. Lands, 20 claims, near Mescal Springs, circa 16 miles west of Fairbank, Has 6 pits and trenches, showing silver bromides and copper carbonates, giving average assays of 12% copper and 100 oz. silver per ton.

LA ROCA-NEGRITA MINING CO. **MEXICO.**

Lands sold, circa 1903, to American-Mexico Mining & Development Co.

LAS ADARGAS MINING CO. **MEXICO.**

Office: 15 John St., New York. Mine office: Jiménez, Chihuahua, Mex. E. G. Seiler, president; Geo. E. Crawford, secretary; W. A. Seamon, general manager, El Paso, Texas. Claims to be organized under laws of New York, with capitalization $1,000,000, shares $10 par. Has a 300′ shaft. Declared a dividend of 25 cents per share, April, 1902. Property said to be held un-

der a bond of $300,000, on which $15,000, has been paid. Regarded with much suspicion, and presumably idle.

LA SAL COPPER MINING CO. **COLORADO.**

Succeeded, 1904, by Consolidated La Sal Mining & Smelting Co.

LAS ANIMAS COPPER MINING & SMELTING CO., LTD. **CHILE.**

Offices: 2, Rumford Place, Liverpool, England. Mine office: Chañaral, Atacama, Chile. Archibald Boxburgh, chairman; Pedro Nicolas Schjölberg, managing director in Chile; F. E. Owens, secretary; Guillermo Sheriff, mine manager. Organized Jan. 3, 1902, as successor of the Copper Corporation of Chili, Ltd., with capitalization £20,000, shares £1 par; issued, £15,000. Lands, 608,500 sq. yds., including the Fortunata mines, 430′ deep, opened 1855, the Alena and Progreso mines, at Las Animas, in the Sierra Aspera district, and a smelting plant at Chañaral, which was blown in March 3, 1902. Production, 1903, was 27,384 metric tons of ore, yielding 2,671 metric tons matte of 61% copper tenor, equal to 3,701,976 lbs. fine copper, giving a return of nearly 6% from ores smelted.

LAS ANIMAS GOLD-COPPER MINING CO. **NEW MEXICO.**

Office: 36-50 State St., Boston, Mass. Mine office: Hillsboro, Sierra Co., N. M. Jas. P. Mallete, president and general manager; Wm. T. D. Teefry, secretary and treasurer; W. W. Williams, superintendent; L. W. Getchell, consulting engineer. Organized 1900, under laws of West Virginia, with capitalization $1,000,000, shares $1 par. Lands, 4 claims, in the Hillsboro district, 22 miles from nearest railway, showing a fissure vein averaging 8′ width, with length of 3,500′, giving assays up to 10% copper, 15 oz. silver and 2 oz. gold per ton, from oxide and sulphide ores. Has a shafts of 150′ and 400′, and 3 tunnels, with 4,000′ of underground openings, estimated by company to give 100,000 tons of ore in sight and 60,000 tons blocked out for stoping. Has steam and gasoline power, with hoist good for depth of 1,000′. Idle at last accounts.

LAS ANIMAS MINING & SMELTING CO. **MEXICO.**

Mine office: Altar, Sonora, Mex. Lands include Las Animas, El Purgatorio and other mines, carrying copper ores. Has steam power. Idle.

LAS COCHES MINING CO. **MEXICO.**

Office: 1085 West 21st St., Chicago, Ills. Mine office: Ures, Sonora, Mex.

LAS GORITAS MINING CO. **MEXICO.**

Office: San Francisco, Cal. Mine office: La Dura, Sonora, Mexico.

LASKAWANDA GOLD & COPPER CO.

Office: 40 State St., Boston, Mass.

MINAS LAS LEONORA y HUERTA. **MEXICO.**

Office: Apartado 16, Aguascalientes, Mex. Mine office: Villanueva, Zacatecas, Mex. G. M. Daniel, general manager; J. M. Daniel, Jr., superintendent and engineer; Manuel Varila, mine superintendent. Lands, 100 acres, also 500 acres miscellaneous lands, in the Jalpa district, showing a fissure vein in porphyry, of 10′ average width, carrying argentiferous galena, argentite, malachite and azurite, with clay gouge, giving average returns of about 5% copper, 10% lead, 200 oz. silver and 29 milligrams gold per ton.

Has shafts of 300′ and 1,000′, with about one mile of underground workings. Was opened by the Spaniards, circa 1820, and reopened 1883. Has steam power and concentrator with 1 crusher and 12 planillas, for treating low-grade ores. Concentrates and smelting ores are shipped 75 miles, by burros, to the plant of the American Smelting & Refining Co., at Aguascalientes. Employed about 150 men, at last accounts.

LAS MORAS COPPER CO. **MEXICO.**

Office: care of L. H. Taylor, Jr., Philadelphia, Pa. Mine office: Ameca, Jalisco, Mex. Geo. E. McCormick, president and general manager. Lands, 149 pertenencias, circa 6 miles southwest of Ameca, on the Hacienda San Miguel. Vein matter is of enormous width, walls not having been encountered in a 500′ crosscut. Development is by circa 3,000′ of tunnels, drifts and crosscuts, estimated to show 100,000 tons of medium grade argentiferous copper ore.

LA SOLEDAD MINING CO. **MEXICO.**

Mine office: Ameca, Jalisco, Mex. C. D. O'Brien, manager. Has copper ores, developed by tunnel.

LAS PLAYAS-SINALOA MINING CO. **MEXICO.**

Office: care of Geo. B. Clark, Commonwealth Trust Bldg., St. Louis, Mo. Apparently is a subsidiary corporation of the Sinaloa Exploration Co.

LAST CHANCE COPPER MINING CO. **WASHINGTON.**

Mine office: Keller, Ferry Co., Wash. Idle.

LAST CHANCE MINE. **UTAH.**

Absorbed, 1904, by Nevada-Utah Mines & Smelters Corporation.

LAST CHANCE MINING CO. **ARIZONA.**

Succeeded, 1902, by Canyon Copper Co.

LAS TUSAS MINING & MILLING CO. **NEW MEXICO.**

Mine office: Tres Piedras, Rio Arriba Co., N. M. Lon. L. Trout, general manager. Has auriferous copper ore, and a steam power plant.

LAS VEGAS COPPER CO. **NEW MEXICO.**

Office: East Las Vegas, N. M. F. A. Manzanares, president; J. M. Thompson, secretary; J. M. Allen, treasurer and general manager; Frank J. Buck, consulting engineer. Capitalization $100,000, shares $1 par. Property is the Tecolote mine, in San Miguel county, New Mexico, showing auriferous and argentiferous copper ore, also a vein of bluestone or natural copper sulphate. Has steam and electric power, and a concentrator. Company claims to have developed about 5,000,000 tons of carbonate ore, which is too much.

LAS VIGAS MINING CO. **MEXICO.**

Office: care of Geo. E. Voorhees, Jr., Santa Barbara, Cal. Mine office: Las Vigas, Coyame, Chihuahua, Mex. Carlos P. Halter, general manager. Lands, 74 pertenencias, area 173 acres, said to show 19 ore bodies, as fissures in sandstone and as contacts between sandstone and what probably is clay-slate, ores occurring as impregnations and replacements in the sandstone. Four of these bodies are being developed, these averaging 7′ to 12′ width and being claimed to give average returns of 7.5% copper and 3 oz. silver per ton, mainly from bornite and chalcopyrite, with occasional oxides, carbonates

and native copper. Has shafts of 61′, 98′, 125′ and 179′, with 3 short tunnels, estimated to develop 60,000 tons of ore. Property formerly was worked by the Spaniards. Has steam power, hoists and air-compressor. Buildings include an office, store and 19 dwellings. Ore is hauled by a Buffalo-Pitts traction engine to Las Trancas station, 43 miles distant, on the Kansas City, Mexico & Orient railroad. Production, 1903, was circa 300,000 lbs. fine copper.

LAS YAQUIS MINING CO. **MEXICO.**

Letter returned unclaimed from former office, San Francisco, Cal. Mine office: El Tiro, Sonora, Mex.

LATHAM MINING & SMELTING CO. **NEVADA.**

Succeeded, circa 1905, by Ohio Lead Mining & Smelting Co.

LATIMER COPPER MINING CO. **GEORGIA.**

Mine office: Pierceville, Fannin Co., Ga. Idle for some years.

LA TOUCHE-IRON MOUNTAIN MINES. **ALASKA.**

Owned by Reynolds-Alaska Development Co.

LATOUCHE ISLAND COPPER MINING CO. **ALASKA.**

Office: 49 Sullivan Bldg., Seattle, Wash. Jas. A. Murphy, president; Solon T. Williams, secretary; R. L. P. Wallace, treasurer. Organized under laws of Washington, with capitalization $5,000,000, shares $5 par. Control is said to have passed, late in 1905, to a New York and London syndicate, under the management of Col. J. Sutherland, which syndicate is said to have raised $100,000 to develop the mine to the point of production. Lands, 29 claims and a millsite, carrying 4 miles of water frontage, on the eastern side of Latouche Island, Prince William Sound, Alaska, circa 60 miles south of Valdez. Lands are well timbered, and show 3 substantially parallel veins of 8′ to 20′ width, which carry 3.5% to 17% copper, opened by 2 short tunnels. Management is said to plan sinking a 250′ shaft. Company refuses to give any information in response to requests, though offering stock to the public, a policy that is utterly opposed to all sound business principles.

LATOUCHE MINING CO. **ALASKA.**

Office: 10 Wall St., New York. Mine office: Latouche, Latouche Island, Alaska. Employs 12 to 30 men, according to season. Andrew K. Beatson, general manager, in whose name all operations are conducted. Organized 1902, under laws of New Jersey, with capitalization $100,000. Is conducted as a close corporation.

Lands, 17 claims, patented, area 340 acres, on the western side and circa 3 miles from northern end of Latouche Island. Property has a good natural harbor, on tidewater. Country rock is slate, showing a vein that has produced chalcopyrite returning 30% copper and 2 oz. silver per ton, and which averages about 10% copper, 2 oz. silver and 20 cents gold per ton. Development is by tunnels, No. 1 being 320′ and No. 2, 650′, with 5 upraises to surface, of 33′ to 43′ height, with a total of 1,400′ of underground openings. Tunnel No. 2 will drain the mine, and also allow ore extraction from the entire property. All upraises are fitted with ore-bins having steel gates, and ore is milled down through same, giving cheap mining costs. Without power equipment, the

property, early in 1906, was extracting ore, and loading same on vessels, at a cost of only $2.25 per ton. Mine has a half mile tram-line of 24″ gauge, laid with 12-lb. rails, and is building another half-mile tram-line of 24″ gauge, laid with 30-lb. rails. Property has a 300′ wharf, on a natural harbor, near the mine. Freight rate to Tacoma, by water, is $2.75 per ton, and ore being desirable for flux, is smelted at an average cost of only $1.65 per ton. Company has a general merchandise store. To end of 1905 the mine shipped circa 3,000 tons of ore, averaging better than 10% copper, to smelters at Ladysmith and Tacoma. The property is one of unusual promise, and is being managed in a thoroughly business-like and satisfactory manner.

LA UNION CONSOLIDATED COPPER CO. **MEXICO.**

Office: care of C. B. Bell, superintendent, Douglas, Ariz. F. J. Pierson, president; John S. Gessell, secretary and treasurer. Lands, 240 pertenencias, including the Reina de Cobre group, circa 35 miles east of La Cananea, and 20 miles west of Fronteras, in the Ajo Mountains. Development is by a 100′ shaft, showing a 30″ vein giving an average sampling of 15% copper, 30 oz. silver and $12 gold per ton. Shipments of 230 tons, taken from a depth of 40′ or less, returned 6% copper, 3.5 oz. silver and $7 gold per ton. Property is considered promising.

LA UNION COPPER MINING CO. **ARGENTINA.**

Mine office: Humahuaca, Jujui, Argentina. Has steam power and a small smelter, employing about 100 men, at last accounts.

LAURA-PEARL MINING & MILLING CO. **COLORADO.**

Mine office: Newett, Chaffee Co., Colo. F. H. Denman, superintendent. Ores carry gold, silver and copper. Has steam power. Presumably idle.

LARIUM MINING CO. **MICHIGAN.**

Office: 301-199 Washington St., Boston, Mass. Mine office: Houghton, Houghton Co., Mich. Albert S. Bigelow, president; Norman W. Haire, vice-president and general manager; Wm. J. Ladd, secretary and treasurer; Wm. J. Uren, general superintendent. Organized under laws of Michigan, with capitalization $1,000,000, shares $25 par. Annual meeting, second Tuesday in June. Lands originally were 640 acres, lying next east of the Calumet & Hecla, but a triangular tract of about 65 acres, carrying both surface and mineral rights, was sold, many years ago, to the Calumet & Hecla Mining Co., and circa 250 acres of surface rights have been disposed of since, as building lots, in the village of Larium, mineral rights being reserved, giving the company present holdings of approximately 325 acres of surface rights, with mineral rights to 575 acres. Property was prospected to some extent, 1904, by diamond drill borings.

LACLEDE CONSOLIDATED GOLD & COPPER MINING CO. **OREGON.**

Office: 518 Broadway, Albany, N. Y. Mine office: North Powder, Union Co., Ore. H. Earle Furman, president; Geo. Oliver, vice-president; W. J. Curtis, secretary; D. Keefer, treasurer; W. N. Gardner, mine manager. Organized June 10, 1900, under laws of Oregon, with capitalization $1,500,000, shares $1 par. Lands, 160 acres, well timbered, 3 miles from a railroad, in the foothills of the Blue Mountains. Development is by several hundred feet

of shafts, tunnels and crosscuts, showing sundry parallel veins of 10″ to 4′ width, carrying ores assaying up to 10% copper, with good gold and silver values, and having an iron gangue. Company plans selling its product to the Oregon Smelting & Refining Co., at Sumpter, but was idle at end of 1905, presumably from lack of funds.

LEAD KING MINE. **COLORADO.**

Mine office: Crystal, Gunnison Co., Colo. T. P. Lamoy, operator, under lease. Ores produced have given average smelter returns of 9% copper, 25% zinc, 8% lead and 20 oz. silver per ton.

LEEDS COPPER CO., LTD. **QUEBEC.**

Letter returned unclaimed from former offices, 11, Bloomfield St., London, E. C., Eng. Mine office: Broughton Station, Beauce Co., Quebec.

LEIGHTON-GENTRY COPPER CO. **WYOMING.**

Succeeded, 1904, by Independence Mining Co.

LEMON MINE. **ARIZONA.**

Mine office: St. Johns, Apache Co., Ariz. Has a 120′ shaft, said to show ore carrying 10% copper, with small gold values.

LENA MINING CO. **NEW MEXICO.**

Letter returned unclaimed from former mine office, Lordsburg, N. M.

LENORA MINING & MILLING CO. **UTAH.**

Office: care of P. C. Evans, secretary, Salt Lake City, Utah. Letter returned unclaimed from former mine office, Milford, Beaver Co., Utah. Miles L. Burns, president; J. D. Carpenter, general manager. Organized Dec. 19, 1903. Lands, 9 claims, known as the Lenora group, in Beaver county, Utah. Idle.

LENORA-MOUNT SICKER COPPER MINING CO., LTD. **BRITISH COLUMBIA.**

Office: Victoria, B. C. Mine office: Duncans, Vancouver Island, B. C. W. Buxton, superintendent, at last accounts. Lands, sundry claims, adjoining the Tyee, on Mt. Sicker, showing a continuation of lenses in a chute of 30′ to 40′ width, with strong gossan capping. Ore produced was divided into two grades, first grade averaging 7.95% copper, 3.57 oz. silver, and 0.17 oz. gold per ton, while the second grade, which was about two-thirds of the total production, averaged 2.3% copper, 1 oz. silver and 0.05 oz. gold. Ore was sent to the Crofton smelter, over a narrow-gauge railway. Management was extravagant, and company is in liquidation, but property is considered promising.

LENOX COPPER MINING CO.

Letter returned unclaimed from former office, 412 Tremont Bldg., Boston, Mass.

LENTZ GOLD-COPPER MINING & REDUCTION CO. **MONTANA.**

Office: 964 Penn Ave., Pittsburg, Pa. Mine office: Sheridan, Madison Co., Mont. Employs 6 to 12 men. C. E. Lentz, president and general manager; F. J. Mangus, vice-president; R. P. McChesney, secretary and treasurer; S. E. Brinnen, superintendent. Organized under laws of Arizona, with capitalization $3,000,000, shares $2 par. Annual meeting, third Friday in Feb-

ruary. Lands, 11 claims, area 220 acres, also a 20-acre millsite, in the Tidal Wave district, 7 miles from Northern Pacific railway, showing country rocks of porphyry, gneiss, granite and quartizte, carrying 10 veins, occurring as fissures in porphyry and as contacts between limestone, gneiss and granite, of which 3 are being developed, these being reported to have average widths of 10′ to 30′, with strong iron cappings, carrying average values of 2% copper, 12% to 50% lead, 12 oz. to 1,400 oz. silver, and $8 to $600 gold per ton. Ores are reported as of all varieties, but presumably are mainly oxidized ores. Development is by shafts of 30′, 130′, 60′ and 110′, and by tunnels of 80′ 100′, 120′ and 1,600′ with a total of 4,800′ of underground openings, estimated to show 8,000 tons of high-grade ore and 160,000 tons of low-grade ore. Has two 60-h. p. hoists, good for 600′ each, also a 1-drill air-compressor and 8 small mine buildings. Company plans continuous development during 1906. The Northern Star mine is in litigation. Property is regarded as promising.

LEONARD MINE. **MONTANA.**

Owned by Boston & Montana Copper & Silver Mining Co.

LERIDA COPPER MINES, LTD. **SPAIN.**

Voluntarily liquidated, September, 1902.

SOCIEDAD ANONIMA MINERA BELGA DE LOS COBRES DE LERIDA y GRANADA. **SPAIN.**

Voluntarily liquidated, September, 1902.

CAMPAGNIE CUIVRES DE LÉRIDE-GRÉNADE. **SPAIN.**

Voluntarily liquidated, September, 1902.

LE ROI MINING CO., LTD. **BRITISH COLUMBIA.**

Offices: 541, Salisbury House, London, E. C., Eng. Mine office: Rossland, Yale district, B. C. Employs circa 400 men. Anthony J. McMillan, managing director and general manager; H. A. Wesson, secretary; A. J. Trevorrow, mine superintendent; A. I. Goodell, smelter superintendent; W. S. Rugh, chief mine accountant. Organized June 7, 1898, with capitalization £1,000,000, shares £5 par. Paid a dividend of 1s., 6d., March 3, 1906, being the first since November, 1899.

Lands, 71.45 acres in fee, and the I. X. L. mine, held under lease. Also owns a good quarry of limestone for flux. Ore body is narrow at top and wide at bottom, but values decrease at depth. Main shaft has 4 compartments and is 1,450′ deep, mine showing reserves, estimated by company at only 39,000 tons of ore, of gross average value of $10.68 per ton. Diamond drill holes, bored from the bottom of the shaft, prove a continuance of the vein to greater depth. Bottom of mine shows 3′ to 5′ of good smelting ore. Property has a good mining equipment, including hoists, air-compressors, power drills, and steam-shovel, with necessary shops and mine structures.

The reduction works, at Northport, Washington, 17 miles from the mine, held in the name of the Northport Smelting & Refining Co., Ltd., are a complete and modern plant, of 1,200 ton daily capacity. Limestone for flux is secured from the company's quarry, only 4 miles distant, and water is supplied from Deep Creek, through a 3-mile flume, 4x5′ in size, leading to two 125,000-gallon storage tanks, whence water is brought in pipes, under a head of 145′, actu-

ating 18″ and 24″ Pelton water-wheels, under an effective pressure of about 60 lbs. per square inch.

The bulk of the ores treated are roasted before charging. Ore is received by rail and dumped into ore-bins of 1,600 tons capacity, elevated 17′ above the roast-yard, which is 500x500′, most of the ore being roasted before smelting. Ore is trammed to the roast-yard on temporary trestles, and roast-heaps are built about 125x350′, and approximately 15′ high, each roast-heap containing about 24,000 tons and requiring 6 weeks for burning. The roasting reduces the sulphur content from 10% to about 3.5%, and wood consumption averages 1 cord per 50 tons of ore. After burned the ore is loaded into self-dumping cars by a steam-shovel, capable of handling 600 tons of ore daily, and cars are hauled up an incline track by a small steam locomotive and dumped into the roasted ore bunkers, immediately behind the blast-furnace building.

The reduction plant includes a 70x98′ sampling mill, with Vezin samplers. The calcining furnace building, 72x350′, has two 35-ton 10x100′ single-deck Holthoff-Wethey furnaces, and one double-deck furnace of the same design and dimensions, latter treating matte and concentrates. The blast-furnace building is 69x240′, with a southern annex of 55x69′, for the silica-mill, and a northern annex 69x100′ for the power plant. There are 6 water-jacket blast-furnaces, with mechanical feed, two being 38x120″ in size, one 40x160″ and three 42x160″, latter with daily capacity of circa 350 tons each. The furnace charges are mixtures of raw and roasted ore, with limestone and coke, charged from side-dumping cars. Steel downtakes of 60″ diameter connect the blast-furnaces with the dust-chamber, which is 10x11x428′, with hopper-bottom and side-discharge gates, leading to a brick smokestack 10′ square and 182′ high. There are also two smaller stacks. Flue-dust is briquetted, with lime for a binder, in two White mineral presses, and resmelted slags are granulated, and washed into the Columbia river.

The power plant at the smelter includes a 400-h. p. Allis-Chalmers engine, two smaller engines, 6 Connersville blowers, a 500-light Westinghouse dynamo and five 250-h. p. Heine boilers. The first-fusion product is a 25% matte, which is roasted, granulated, briquetted and blown up to 50% matte, carrying considerable gold values and small silver values, which is shipped to New York for conversion and refining. In addition to treating Le Roi ores, the Northport smelter does a general custom business.

For the fiscal year ending June 30, 1904, production was 160,109 dry tons of first-grade ore, of the gross value of $1,752,024, equal to $10.94 per ton, and 19,013 tons of second-grade ore, worth $143,078, equal to $7.52 per ton. Production of fine copper, for fiscal year 1902, was circa 4,750,000 lbs. Operations showed a net loss of £88,195 in the fiscal year 1904, and a net profit of £49,741 in 1905. There has been a bitter fight among Le Roi shareholders, for two years past, this culminating in the summary removal of Mr. McMillan from the directorate, by his associate directors. This action was repudiated by the shareholders, at the annual meeting in 1906, and Mr. McMillan was again placed in power and signalized his victory by declaring a dividend. Efforts to consolidate the Le Roi with the Centre Star and

War Eagle were blocked by Mr. McMillan, who is as redoubtable a warrior as any of the paladins of old. The entire fight began over a disagreement between the Canadian Pacific and Great Northern railways over ore tonnage, the former desiring the abandonment of smelting at Northport, which is in the United States. After Mr. McMillan's ouster, the Northport smelter was closed and a three-year smelting contract made with the Trail smelter, but this is not recognized by Mr. McMillan. The property is making a little money, and Mr. McMillan apparently will be able to earn small but welcome profits, for the shareholders.

LE ROI NO. 2, LTD. **BRITISH COLUMBIA.**

Offices: Salisbury House, London, E. C., Eng. Mine office: Rossland, Yale district, B. C. Employs circa 200 men. Lord Ernest Hamilton, chairman, F. A. Labouchere, secretary; Alex. Hill & Stewart, consulting engineers; P. S. Couldrey, mine manager; R. R. Cormack, assistant manager. Organized June 1, 1900, with capitalization £600,000, shares £5 par.

Lands, 72 acres, including the Josie and No. 1 mines, in addition to which the company added, during 1905, 8 claims, near the old mine, 2 claims in the Rossland district adjacent to the Velvet mine, and 5 claims in the Ymir district. The mine is about 600′ deep, the Josie showing a new and important ore body on the 500′ level, with indications of even better values on the 600′, or bottom level. Ores carry values in gold, copper, and silver, in the order named, and are graded into two classes, for smelting and concentrating. Ore reserves have been estimated at 300,000 tons, which seems rather high. During 1904 and 1905, the company drilled 6,738′ of diamond drill holes, at a cost of $2.70 per foot in 1905.

Late in 1903 an Elmore oil concentrator, fully described in Vol. IV, was installed. This proved a technical but not a commercial success, and was superseded by Wilfley tables. The reasons for this outcome were several in number, among them being an advance in the price of oil, the extremely low grade of the tailings handled, and last, but probably most important, the small supply of material, which averaged only about 20 tons daily for a 50-ton plant, placing this interesting new process at a great disadvantage in tonnage costs. It is to be hoped the Elmore oil process may be given a fairer and more exhaustive test on low-grade tailings, where its technical advantages may be supplemented by fairer conditions.

Ores, formerly sent to the Greenwood smelter, are now treated at the Trail works, a 3-year contract for reduction having been made in 1905. Production, 1905, was 12,237 tons of smelting ore and 10, 678 tons of concentrating ore, mined at a cost of $4.22 per ton, and costing $8.70 per ton for freight and smelting. The smelting ore gave average returns of 3.62% copper, 2.32 oz. silver, and 1.184 oz. gold per ton, with total gross values of $35.78 per ton, an increase in gross values, Production of metals, for fiscal year 1905, was 885,992 lbs. fine copper, 28,365 oz. silver and 14,493 oz. gold. Largest copper production was 3 001,027 lbs., in the fiscal year 1902.

LE ROY MINING CO. **MEXICO.**

Office: Pilares de Teras, Sonora, Mex. Lee Benton, manager. Ores carry silver, gold and copper. Presumably idle.

LESLIE COPPER MINING CO. **IDAHO.**

Mine office: Mullan, Shoshone Co., Idaho. Lands, sundry claims, east of Mullan, opened by 2 tunnels, lower showing a strong vein of silver-lead ore, of milling grade, and a narrow copper paystreak. Was developing at close of 1905.

L'ETETE GOLD & COPPER MINING CO. **NEW BRUNSWICK & NOVA SCOTIA.**

Mine office: L'Etete, Charlotte Co., New Brunswick. Property is the old Johnston mine, opened circa 1860, reopened 1902, having two short tunnels and a 145′ main shaft, showing ore of good assay value. Has a steam plant, and shipping facilities at tidewater. Company also owns mineral lands in Nova Scotia. Presumably idle.

LEVANT MINING CO., LTD. **ENGLAND.**

Offices and mines: St. Just, Cornwall, England. T. R. Bolitho, chairman; Maj. R. White, secretary. Organized 1872, as a cost-book company, with 2,500 shares, 2,385 issued, £12 4s. 6d. paid in. Dividends, £25 6s. per share, last, 5 shillings, paid January, 1904. Mine produces tin and copper, mainly the former, and has been continuously worked since 1820, paying £170,000 in dividends, during its first 20 years of operation. Is now a small producer only.

LEVIATHAN MINE. **CALIFORNIA.**

An idle mine, 10 miles east of Markleeville, Alpine county, California. Ore occurs as lenses, in porphyry. Mine is opened by tunnels of 400′ and 700′.

LEWISOHN EXPLORATION & MINING CO.

Office: 11 Broadway, New York, J. Parke Channing, general manager; Martin H. Vogel, counsel. Organized January 5, 1906, under laws of New Jersey, with capitalization $5,000, which it is planned to increase to $50,000,000, by easy stages, as properties are acquired. Plan of promotion and finance is somewhat similar to that of the American Smelters Securities Co. It is supposed that this company will become a securities-holding corporation for the various Lewisohn interests, which include the Tennessee Copper Co. and General Development Co., with a considerable share interest in the Nevada Consolidated Copper Co.

LEXINGTON MINE. **MONTANA.**

Owned by La France Copper Co.

LIBERTY COPPER MINING & MELTING CO. **MARYLAND.**

Dead. Property sold to Virginia Consolidated Copper Co.

LIBERTY GOLD & COPPER CO.

Office: Prescott, Ariz. Frank Burns, manager. Property is on the line of the Arizona & California Railroad, in vicinity of Bill Williams Fork river, a tributary of the Colorado river, and presumably is in Yuma county, Arizona, though possibly in San Bernardino county, California. Is slightly developed, but is said to give a promising showing.

LIBERTY MINING & SMELTING CO. **ARIZONA.**

Letter returned unclaimed from former mine office, Tucson, Pima Co., Ariz. Ores carry silver, lead and copper. Has gasoline power.

SOCIETA ANOMINA PER L'ESERCIZIO DELLA MINIERE DE LIBIOLA. **ITALY.**

Mine is leased to Libiola Copper Mining Co., Ltd.

LIBIOLA COPPER MINING CO., LTD. **ITALY.**

Offices: 138, Leadenhall St., London, E. C., Eng. Mine office: Sestri Levante, Liguria, Italy. Kenneth Haweis James, chairman; preceding officer, T. V. Anthony and A. Strove, directors; W. S. Bartlett, secretary; Robert H. Craven, mine manager. Organized 1888, under laws of Great Britain, (as reconstruction of a company of same name, organized January, 1867,) with capitalization £250,000, shares £5 par. Paid dividends of 2s. 6d. in 1903; 3s. 6d. in 1904, and 3s. 6d. in 1905, with total dividends, to end of 1905, of £4 10s. Annual meeting, April 30. Company has a heavy share interest in the Cruccuen silver-lead mine, Sardinia, now idle. Lands, 2 claims, area circa 700 hectares, freehold, including the Libiola copper mines, in Liguria, northern Italy. Ores are chalcopyrite and iron pyrites, occuring as veins in serpentine and diabase, ore bodies being of good size. The property was discovered and worked by the Romans and was reopened, 1867, by predecessor of present company. Ores produced average 5.76% copper in the cupriferous ore and 46.75% sulphur in the pyrites. Mine is estimated to have 91,880 long tons of ore in sight, with 80,000 tons blocked out for stoping, this including both copper and iron pyrites. Equipment includes a 60-h. p. steam plant, 30-h. p. water plant and 50-h. p. electric plant.

The crushing mill, covering 550 square meters, built of reinforced concrete and stone, has a daily capacity of 180 tons. Production, 1905, was 28,388 tons of copper and iron pyrites, of which about 20% was copper ore. Company has a good management, and, by careful handling, the property is made to return very satisfactory profits.

SOCIÉTÉ DES MINES DE LA LIENNE. **ITALY.**

Mine offices: Alagna and Riva, Circondario di Varallo, Novarra, Italy. Ore is medium grade chalcopyrite. Mines are worked on a limited scale.

SOCIETA LIGURE RAMIFERA. **ITALY.**

Mine office: Casarza, Ligure, Italy. Mines include the Fontanelle, Rio Albareta, Rio Monticello and Rio dei Fichi. Ore is chalcopyrite, in quartzose gangue. Is a regular producer, on a small scale.

LILYAMA MINE. **CALIFORNIA.**

Office: care of Robt. Crocker & Co., Placerville, Cal. Mine office: Auburn, El Dorado Co., Cal. Lands, 240 acres, unpatented, 11 miles from Auburn. Ores, mainly sulphides, occur as lenses in limestone, lying between granite and quartz-porphyry. Has 4 tunnels and a prospecting shaft. Idle.

LILLY MINING & MILLING CO. **COLORADO.**

Mine office: Idaho Springs, Clear Creek Co., Colo. Ores carry gold, silver, lead and copper. Has steam power.

LIMA COPPER MINING SYNDICATE, LTD.

Voluntarily wound up, February, 1903.

LIME CREEK CONSOLIDATED GOLD & COPPER CO. **ARIZONA.**

Dead. Property sold to Kentucky-Arizona Consolidated Mining, Smelting & Development Co.

LINARES MINING SYNDICATE, LTD. **SPAIN.**

Mine office: Linares, Jaen, Spain. S. Moos, manager. Organized, 1903, to exploit lead, copper, zinc, iron and coal properties in the vicinity of Linares. Planned constructing a large warehouse and shipping pier, at Almeria, Spain. Presumably idle.

LINCOLN CONSOLIDATED COPPER CO. **NEW MEXICO.**

Office: care of Daniel D. Hunt, St. Joseph, Mo. Mine office: Jarilla, Otero Co., N. M. Organized April 13, 1906, under laws of New Mexico, with capitalization $50,000. Lands, said to be 2 claims, held under bond and lease from the Southwest Smelting & Refining Co. Mine shows a 5′ vein, opened by a shallow 2-compartment shaft, from which a carload shipment of ore, taken from a depth of less than 15′, gave returns of 11.1% copper and 3 oz. silver per ton.

LINCOLN CONSOLIDATED MINING CO. **ARIZONA.**

Office: 1563 Sherman Ave., Evanston, Ills. Mine office: Tucson, Pima Co., Ariz. Employs 30 men. Chas. A. Wightman, president; Fred W. Tickett vice-president and general manager; Geo. E. Fernald, secretary and treasurer; H. B. Sturtevant, superintendent. Organized June, 1904, under laws of Arizona, with capitalization $2,000,000, shares $1 par; issued, $1,200,000. Annual meeting first Monday in June.

Lands, 35 claims, area 700 acres, including the Garcia group of 31 claims, also a 100-acre millsite, with total holdings of circa 1,000 acres, in the Papago district, showing country rocks of limestone, granite-porphyry and diorite, carrying various ore bodies, of which 5 are slightly developed, these ranging 4′ to 25′ in width, and being opened by 6 shafts, of 50′ to 120′ depth, of which 3 are being deepened, and by a 150′ tunnel. Smelter shipments from Providence claim are said to have given average returns of circa 30% copper, with fair gold and silver values, and property is said to have produced about $80,000 worth of ore. Equipment includes two 15-h. p. gasoline hoists, good for 400′ depth, and a 15-drill Rand air-compressor. There are 5 buildings, including an 18x20′ machine shop, 14x60′ smithy, store and several dwellings. Property is 12 miles from the Twin Buttes railroad, which is said to plan building a branch line thereto.

LINCOLN COPPER CO. **ARIZONA.**

Succeeded, circa 1904, by Lincoln Consolidated Mining Co.

LINCOLN COPPER DEVELOPMENT CO.

Office: 326 Post St., San Francisco, Cal. Location of property, if any, not learned. Company is regarded with suspicion, owing to the address given having been the hiving place of a swarm of more than doubtful mining propositions, put out by one "Baron" W. E. von Johannsen, a notorious grafter.

LINCOLN COPPER MINING CO. **ARIZONA.**

Office: 321 Spruce St., Aurora, Ills. Capitalization $3,000,000, shares $1

par. Lands claimed were 42 claims, area circa 850 acres, in the Sierrita Mountains, now held by the Lincoln Consolidated Mining Co.

LINCOLN COPPER MINING CO. **MONTANA.**

Office: care of Jas. A. Talbott, Butte, Montana. Incorporated July, 1903, under laws of Montana, with capitalization $1,500,000, shares $1 par. Among the incorporators given was Thos. H. Carter, but Senator Carter writes that his name was used without his knowledge or consent. Lands, said to be 10 claims, in the Little Boulder district, about 30 miles from Helena Lewis & Clark county, Montana.

LINCOLN MINE. **NEVADA.**

Mine office: care of John F. Lincoln, manager, Goodsprings, Lincoln Co., Nev. Property shows ores assaying up to 15% copper, with gold and silver values.

LINCOLN MINE. **UTAH.**

Mine office: Minersville, Beaver Co., Utah. Gus Stoney, superintendent, at last accounts. Ores carry silver, lead and copper. Is opened by shaft, and has steam power. Idle.

LINCOLN MINING & MILLING CO. **COLORADO.**

Mine office: Idaho Springs, Clear Creek Co., Colo. Ores carry gold, silver, copper and lead. Has steam power and a 15-stamp mill.

MINA LINEA DIVISORIA. **CHILE.**

Mine office: Chañaral, Atacama, Chile, Braniff y Roldan, owners. Employed about 25 men, at last accounts.

LINEDALE WEST CHILLAGOE, LTD. **AUSTRALIA.**

Dead.

LION COPPER MINING CO. **ARIZONA.**

Office: 313 West Second St., Los Angeles, Cal. Mine office: Stoddard, Yavapai Co., Ariz. Chas. Matthews, president; O. A. Cox, secretary and treasurer; Henry Reifsnyder, general manager. Organized February, 1903, under laws of Arizona, with capitalization $2,500,000, shares $1 par. Lands, 13 claims, area 260 acres, in the Agua Fria district, 6 miles from the nearest railroad. Country rocks are limestone, quartzite and dioritic porphyry, showing numerous veins carrying oxide, carbonate and sulphide ores, giving average assays of 24% copper, opened by shafts of 50′, 100′ and 300′, with 515′ of underground workings. Has gasoline power, and is diamond drilling from bottom of the 300′ shaft.

LION GOLD MINIING & MILLING CO. **COLORADO.**

Mine office: Silverton, San Juan Co., Colo. Chas. Newman, superintendent. Ores carry gold, silver and copper. Has steam power.

LITHGOW COPPER SMELTING & REFINING WORKS. **AUSTRALIA.**

Owned by Great Cobar Copper Mining Syndicate.

LITTLE BAY MINE. **NEWFOUNDLAND.**

Idle. Owned by Carmen Copper Mines, Ltd.

LITTLE BULLY HILL MINING & SMELTING CO. **CALIFORNIA.**

Letter returned unclaimed from former office, San Francisco, Cal. Capitalization $1,000,000, shares $1 par. Lands, 5 claims, said to adjoin the Bully

Hill mine, opened by a 130′ tunnel and several trenches, said to show sulphide ore. Presumably dead.

LITTLE GIANT MINING, MILLING & SMELTING CO. **WASHINGTON.**

Letters returned unclaimed from former office, Spokane, Wash., and from former mine office, Marcus, Stevens Co., Wash.

LITTLE HELVETIA MINE. **ARIZONA.**

Owned by Tip Top Mining Co.

LITTLE MATTIE MINING, MILLING & POWER CO. **COLORADO.**

Mine office: Idaho Springs, Clear Creek Co., Colo. F. V. S. Leebrick, superintendent. Ores carry gold, silver, lead and copper. Has steam and water power and a 20-stamp mill.

LITTLE NORTH FORK MINING & MILLING CO. **IDAHO.**

Mine office: Wardner, Shoshone Co., Idaho. J. Kalbenbach, superintendent. Is developing by tunnels.

LIVE OAK COPPER MINING & SMELTING CO. **ARIZONA.**

Office: 438 Broome St., New York. Mine office: Globe, Gila Co., Ariz. Employs 300 men. Forest J. Kaldenberg, president; Forest J. Kaldenberg, Jr., vice-president; G. W. Augustin, secretary and treasurer; Jos. C. Erman, general manager; Edward P. Worthington, superintendent; Geo. F. Wilson, mine superintendent. Organized under laws of Arizona, with capitalization $1,250,000, shares $1 par.

Lands, 16 claims, area 320 acres, in the Globe district, showing country rocks of schists and quartz-porphyry, with lenticular ore bodies occurring in contact veins. Property shows 8 known veins, of which 3 are under development, these averaging 10′ width by 700′ proven length, and 300′ estimated average depth, carrying chalcocite, chalcopyrite, chrysocolla and dioptase, giving average returns of 10% copper. Mine has shafts of 85′ and 250′, and tunnels of 900′, 125′, 175′, 185′, 725′ and 60′, with a total of about one mile of underground workings, estimated to show 120,000 tons of ore, with 65,000 tons blocked out for stoping. Ore shipped is graded into first class, carrying circa 24% copper, and second-class, averaging 12% copper. Property was discovered 1888, opened 1897, closed the same year, through mismanagement, and reopened, September 1, 1905, by Mr. Erman.

Mine has a 200-h. p. hoist, good for 1,500′, and an 8-drill Sullivan air-compressor, with 12 buildings, for various uses. The Gila Valley, Globe & Northern Railroad, 8 miles distant, will build a spur to the mine. Fuel is crude petroleum.

Production, 1905, was 587,961 fine lbs. copper, and 1906 output will be much larger. Ore is shipped to the Old Dominion smelter, at Globe, Copper Queen reduction works at Douglas, and the El Paso plant of the American Smelting & Refining Co. December production gave about $30,000 net smelter returns, and the company has contracted to ship 1,500 tons of silicious sulphide ore monthly, to the El Paso smelter. Mr. Erman took charge of the property September 1, 1905, after 9 years of idleness, with the exception of a little gophering, done by 30-day leasers. The company furnished absolutely no capital, and Mr. Erman took out sufficient ore, in 6 months, to pay all operating

expenses, and to expend $20,000 on mine equipment, ore-bins, machinery and roads, in addition to securing a large amount of development. There has been some hitch between the owners, with Mr. Kaldenberg on one side and Mr. Erman on the other, it appearing that Mr. Kaldenberg awoke suddenly to the fact that the property was very valuable, and desired to regain control immediately, at the expense of Mr. Erman and various leasers. Sympathy, in the Globe district, is overwhelmingly with Mr. Erman, and he is entitled to the greatest degree of credit for the altogether admirable manner in which he has rejuvenated and developed this property, which bids fair to develop ultimately into one of the big copper mines of Arizona.

LIVERMORE GOLD & COPPER MINING CO. **WYOMING.**

Letters returned unclaimed from former office, Laramie, Wyo. Organized May, 1902, with capitalization $1,000,000, to take over the Cumberland, Empire, Flying Dutchman, and Eureka claims, in the vicinity of Laramie.

MINAS LLANOS BLANCOS y LOS PATOS. **CHILE.**

Mine office: Tamaya, Tongoya, Ovalle, Chile. Opened 1903. Main shaft is 250′ deep. Idle.

"LLOYD" COPPER CO., LTD. **AUSTRALIA.**

Offices: 195A, Winchester House, London, E. C., Eng. Mine office: Burraga, County Bathurst, New South Wales, Australia. Employs circa 350 men. Alexander Creighton Arthur, chairman; W. H. Corbould, general manager; H. A. McMahon, secretary. Organized May 9, 1899, with capitalization £250,000, shares £1 par; debentures, £50,000, first mortgage, at 10%, payable £10,000 annually, beginning July, 1906. Had a stock interest in the Murrin Copper Co., Ltd., which proved a failure.

Lands, 380 acres freehold and 385 acres leasehold, in the Bathurst district. Ore is slightly argentiferous chalcopyrite, with quartzite gangue, occurring in fissures traversing acid diorite. Mine, opened 1877, is extensively developed, main shaft, 2,300′, being bottomed in badly disturbed ground. Ore is lower in grade at depth, and company is said to have decided to close down the old mine, early in 1906, except for a little scramming. Other propertures are being opened, with a view to replacing the production of the old mine. Operations are suspended occasionally, from lack of water, although the mine has an 85,000,000-gallon storage tank, holding water for about 9 months supply.

The reduction plant, built 1901, at a cost of £32,000, includes a concentrator and smelter. The latter had two blast furnaces, one of which was sold to the Murrin Copper Co., which was wound up at a heavy loss, so the furnace was practically lost. The other has been sold to the Great Cobar, and reverberatories are used exclusively. In 1905 the largest reverberatory furnace in New South Wales was built at this smelter, which also has a convertor plant. Equipment includes an electric plant and necessary steam and winding machinery. Fuel is wood, of which 60,000 cords are burned yearly. Production has decreased for several years past, amd for fiscal year 1905 was only 2,058,560 lbs. fine copper. Property enjoys a good management.

LLUVIA DE COBRE MINING CO. **MEXICO.**

Office: 407 Fidelity Trust Bldg., Kansas City, Mo. Wm. E. Jones, mana-

ger. Lands include several copper and silver claims, in the Papago district, circa 50 miles south of Hermosillo, Sonora, Mexico.

LOCH WINNOCH MINE. **SCOTLAND.**

An old and long idle property, about 9 miles from Glasgow, at Loch Winnoch, Renfrewshire, Scotland.

LOG CABIN GOLD & COPPER CO., LTD. **UTAH.**

Office: 606 D. S. Morgan Bldg., Buffalo, N. Y. Mine office: Marysvale, Piute Co., Utah. P. S. Merrill, president; H. M. Tyler, vice-president; J. I. Stanton, secretary; M. H. Fralic, treasurer; preceding officers, A. J. Hathaway, L. L. Flower and G. R. Watson, directors; M. F. Murray, general manager; Ole Larsen, superintendent. Organized November 26, 1901, under laws of Ontario, with capitalization $3,000,000, shares $1 par. Lands, 67 claims, area 1,350 acres, in the Mount Baldy district, 12 miles west of Marysvale, the terminus of the Rio Grande & Eastern railroad. Company formerly owned 700 acres on Wild Potato Lake, 12 miles east of Mine Centre, Rainy River district, Ontario, carrying a gold-bearing quartz vein, on which 2 shallow shafts were sunk, and 240 acres on Heron Bay, Lake Superior, Ontario, said to show indications of copper. Letter returned unclaimed from former office at Mine Centre, and company reports Utah holdings only, so Canadian lands doubtless were lost. Development of Utah lands is by a little more than 3,000′ of workings, mainly in three tunnels, of which the Franklin tunnel only is driving at present. Property is said to show a wide vein, giving average assays of $10 per ton. Machinery includes an air-compressor at the Franklin tunnel.

LOMAGUNDA DEVELOPMENT CO., LTD. **RHODESIA.**

Offices: Salisbury House, London, E. C., Eng. John Secar, chairman; H. Ewer Jones, consulting engineer; Geo. T. Frost, secretary; Rhodesia Exploration & Development Co., Ltd., agent in Rhodesia. Organized June 18, 1894, capitalization increased December, 1901, to £250,000, shares £1 par; issued, £227,850. Paid a 10% dividend, November, 1905. Lands, 407 claims, in the Lomagunda district of Mashonaland, including the United Kingdom claim, on which development, now under way, has shown a promising body of auriferous copper ore. Company also has extensive shareholdings in the Consolidated African Copper Trust, Ltd., Ayrshire Gold Mine & Lomagunda Railway Co., Ltd., and Rhodesian Banket Co., Ltd.

LOMA VERDE COPPER CO. **ARIZONA.**

Letters returned unclaimed from former office, 316 Bradbury Bldg., Los Angeles, Cal. A stock-jobbing scheme, which paid a small dividend, 1903, and then closed down. Fully described in Vol. V.

LOMBARD COPPER CO. **OREGON.**

Letter returned unclaimed from former office, Baker City, Ore. Organized July 19, 1902, by F. L. Evans, H. C. Pearson and W. G. Main, with capitalization $2,000,000. Apparently dead.

LOMBARD GOLD & COPPER MINING CO.

Letters returned unclaimed from former office, Salt Lake City, Utah.

LONDON-COLORADO PROPERTIES, LTD. **COLORADO.**

Mine office: Central City, Gilpin Co., Colo. Has a bond and lease on the

Pierce mine, near Central City, which gives a good showing of copper ore.

LONE PINE MINING CO. **ARIZONA.**

Absorbed by Pan American Mining & Smelting Co. Was a bad egg.

LONE STAR COPPER CO. **TEXAS.**

Letters returned unclaimed from former mine office, Henrietta, Clay Co., Texas. Described in Vol. III.

LONE STAR MINE. **ARIZONA.**

A property near Williams, Coconino county, Arizona, now known as the Central Arizona mine.

LONE STAR MINE. **ARIZONA.**

A property near Solomonville, Graham county, Arizona, owned by Maravilla Copper Co.

LONG BEACH & ARIZONA MINING CO. **ARIZONA.**

Office: care of Southwestern Securities Co., Los Angeles, Cal. Mine office: Jerome Yavapai Co., Ariz. T. H. Brown, president; A. E. Brown, vice-president; T. C. Jordan, secretary; C. E. Nathorst, general manager. Organized September, 1905, under laws of Arizona, with capitalization $500,000, shares $1 par. Lands, 7 claims, known as the Rawhide group, a short distance south of Jerome, opened by a 100′ shaft.

LOOKOUT GROUP. **ALASKA.**

Office: care of H. H. Wakefield, Ketchikan, Alaska. Lands, 6 claims, at Niblack Achorage, Prince of Wales Island, Alaska, said to give a fair showing of medium-grade copper ore.

LORDSBURG MINING & REDUCTION CO. **NEW MEXICO.**

Office: care of Thomas A. Lister, Lordsburg, Grant Co., N. M. Organized April, 1906, with capitalization $600,000.

COMPAÑIA MINERA LORETA y PROVIDENCIA. **MEXICO.**

Mine office: Candamena, Chihuahua, Mexico. Owned by Jesus Poyval, Rascon Bros. and E. R. Bones. Ores carry silver, copper and lead. Has a 500′ main shaft and a 900′ tunnel, with water power, 5-stamp mill and a one-ton smelter.

LORRAINE COPPER MINING CO. **WASHINGTON.**

Office: Hoquiam, Wash. Mine office: Keller, Ferry Co., Wash. Owen Jones, president; A. G. Rockwell, secretary; Fred J. Chamberlain, general manager. Organized April 13, 1900, under laws of Washington, with capitalization $1,500,000, shares $1 par. Lands, 22 claims, area 422 acres, also a 20-acre millsite, in two groups, the Wilmot group being in the Sans Poil mining district of Ferry county, and the Lorraine group in the Carbon River district of Pierce county, Washington. Properties show 7 ore bodies, as fissures in granite on the Lorraine group, and as contact veins between porphyry and schist on the Wilmot group. Contact veins of the Wilmot group are 4′ to 6′ wide and give average assays of 6.5% copper, 40 oz. silver and $4 gold per ton; fissure veins on the Lorraine group give assays of 20% copper, 5 oz. silver and $10 gold per ton. The Wilmot group shows malachite and azurite near surface, with chalcocite, bornite, and chalcopyrite at depth. The Lorraine group shows bornite and chalcopyrite. Developments on

the Lorraine include 4 shafts, deepest 100′, and 8 tunnels, 3 longest being 221′ 472′ and 630′. Properties have 2,016′ of underground openings. Idle

LOS ALAMOS MINING & MILLING CO. **MEXICO.**

Office: care of Dr. Finis E. Yoakum, president, Los Angeles, Cal. Letter returned unclaimed from former mine office, Alamos, Sonora, Mex. Claimed to have an encouraging showing of auriferous copper ores. Not favorably regarded.

LOS CERROS COPPER CO. **CUBA.**

Office: Blackstone Bldg., Cleveland, Ohio. Mine office: Fomento, Santa Clara province, Cuba. Idle. S. S. Saffold, president; W. C. Watkins, vice-president; Sherman C. Dalbey, secretary; W. L. Rees, treasurer; Col. D. H. Pond, general manager. Organized August 12, 1905, under laws of Arizona, with capitalization $500,000, shares $100 par. Lands, 2 claims, area 100 acres, also 1,500 acres of miscellaneous lands, opened by shafts of 25′, 35′, and 50′, and by tunnels of 80′, 80′, 200′, 205′ and 250′, showing ore assaying 10% copper, 20% to 25% zinc, 20% sulphur and 30% silica, with gold and silver values. Zinc apparently is decreasing at depth. Vein has a 12′ to 15′ gossan outcrop along its strike. Property is an antigua, operated in the Eighteenth Century, and idle since circa A. D. 1750.

LOS MARCHES MINING CO. **MEXICO.**

Mine office: Indé, Durango, Mex. Was completing a new concentrator and smelter, early in 1906.

LOS MUERTOS MINING CO. **MEXICO.**

Mine office: Velardeña, Durango, Mex. Carter Barker, superintendent. Ores carry copper, silver and lead. Has steam power and employed about 100 men, at last accounts.

LOST GARNET GOLD & COPPER MINING & MILLING CO.

Letter returned unclaimed from former office, Everett, Wash.

LOST GULCH COPPER CO.

Letter returned unclaimed from former office, Los Angeles, Cal.

LOST PACKER EXTENSION MINING CO. **IDAHO.**

Office: care of Col. O. P. Chisholm, secretary and treasurer, Bozeman, Montana. W. W. Chisholm, president. Is claimed to have a smelter in operation at mines on Loon Creek, circa 90 miles from Murray, Idaho.

NUEVA SOCIEDAD COMPAÑIA DE LOTA i CORONEL. **CHILE.**

Office: Valparaiso, Chile. Mine office: Chañaral, Atacama, Chile. Santiago Collins, manager. Capitalization, $18,000,000. Owns and operates mines in different parts of Chile. The Descubridora mine, at Carizalillo, Chañaral, was opened 1850 and is about 650′ deep. The Lota mine, opened 1856, in the department of Lautaro, and the Maitenes, opened 1844, in the department of Santiago, are among the more important copper mines, and the company also owns sundry coal mines. The leading mines and the smelter, are equipped with steam and electric power, and the latter has a converter plant and refinery. Production averages circa 10,000,000 lbs. fine copper yearly, shipped to Europe as Chile bars and ingots.

LOTUS GROUP. **COLORADO.**

Mine office: Russel Gulch, Gilpin Co., Colo. L. Sternberger, superintendent. Ores carry gold, silver and copper. Has steam power.

MINA DO LOUZAL. **PORTUGAL.**

Office: 4, Praca dos Remolares, Lisbon, Portugal. Mine office: Louzal, Grandola, Alemtejo, Portugal. Is the property of a syndicate of 6 owners. Senhor Waldemar d'Orey, general manager; Joaquin Chaves, mining captain. Lands, 1 square kilometre, showing 6 known ore bodies, largest with maximum width of 25 metres, other dimensions unknown, giving returns of 0.5% to 13% copper and 1.2 oz. silver per ton, with traces of lead, zinc and gold, mainly from cupriferous iron pyrites, with occasional oxides and a little native copper. Has 4 shafts, of 12 to 30 metres depth, and a 300-metre tunnel, with about 1,000 m. of underground openings, estimated by owners to show about 3,000,000 tons of ore. Property was discovered and opened by the Romans, and was reopened by present owners in 1901.

LOW DIVIDE COPPER MINING CO. **CALIFORNIA.**

Office: care of John Murray, president, Crescent City, Cal. Lands are the Alta, Occidental and Copper Hill groups, in Del Norte county, California, on which several different veins have been opened slightly, these showing oxide, carbonate and sulphide ores of good grade. Presumably idle.

LOWER MAMMOTH MINING CO. **UTAH.**

Office: Salt Lake City, Utah. Mine office: Mammoth, Juab Co., Utah. Sidney Bamberger, manager. Wm. Ball, superintendent. Has 150,000 shares. Main shaft, 1,200'. Has steam and electric power, and employs circa 125 men. Ores treated, 1902, averaged 3% copper, 52 oz. silver and 85 cents gold per ton.

LOYAL LEASE MINE. **BRITISH COLUMBIA.**

Mine office: Van Anda, Texada Island, B. C. H. W. Treat, owner. Lands, circa 3 miles from Van Anda, show outcrops similar to those of the Marble Bay mine. Development is by a 200' shaft, showing bornite and chalcopyrite of good grade. Has steam power and plans making small ore shipments during 1906.

GUSTAVO LOZANO. **SAN SALVADOR, C. A.**

Mine office: Chalatelango, San Salvador, Central America. Produces copper, gold and silver, on a small scale. Has steam power, and employed about 100 men, at last accounts.

LUCERO COPPER MINING CO. **NEW MEXICO.**

Letters returned unclaimed from former mine office, Mora, Mora Co., N. M.

LUCKY DAY MINING CO. **WASHINGTON.**

Letter returned unclaimed from former office, Seattle, Wash. Lands, in the Silver Creek camp, Snohomish county, Washington, are said to show a 6' vein of copper ore, opened by a 300' tunnel.

LUCKY DUTCHMAN MINING & DEVELOPMENT CO. **NEVADA.**

Office: care of H. B. Cole, secretary-treasurer, Salt Lake City, Utah

W. J. Snyder, president; John R. Royer, vice-president; preceding officers, B. O. Atkins, C. L. Anderson, and R. S. Weimer, directors. Organized 1905, with capitalization $125,000, shares 25 cents par. Lands, 4 claims, in the Crescent district of Lincoln county, Nevada.

LUCKY GOLD & COPPER MINING CO. **ARIZONA.**

Mine office: Kelvin, Pinal Co., Ariz. J. D. Ferree, president. Lands, sundry claims, in the Riverside district, undeveloped, but with good surface showings.

LUCKY STRIKE COPPER MINING CO. **WYOMING.**

Office and mine: Rawlins, Carbon Co., Wyo. Organized 1904, to develop sundry claims 5 miles northwest of Rawlins. Presumably idle.

LUCKY VERDE COPPER CO. **ARIZONA.**

Dead. Lost lands, 1904.

LUCY L. MINING & MILLING CO. **UTAH.**

Frank L. Wilson, secretary and treasurer. Property, in the Deep Creek district of Juab county, Utah, is said to present a good surface showing of rich copper ore. Presumably idle.

LUDWIG COPPER MINING CO. **NEVADA.**

Mine office: Yerington, Lyon Co., Nev. Has auriferous and argentiferous copper ores, including exceptionally handsome malachite and azurite, considerable quantities of which are sold to lapidaries. Mine water is claimed to carry 1.6% copper, and development is now below the water-level. Has steam power and a 30-ton smelter, but needs a railroad connection. Shipments were resumed, 1906, to the Tacoma smelter.

KUPFERBERGWERK LUDWIGSDORF. **GERMANY.**

Mine office: Ludwigsdorf, Schlesien, Germany. Employed 40 men, at last accounts.

LUKE CREEK GOLD-COPPER MINING CO. **BRITISH COLUMBIA.**

Office: 435 Temple Court, Minneapolis, Minn. Letter returned unclaimed from former mine office, Marysville; Fort Steele division, East Kootenai, B. C. S. D. Pumpelly, president and general manager; E. D. Barcalow, secretary. Capitalization $1,000,000, shares $1 par. Lands, 2 claims. Idle.

LUSTRE MINING CO. **MEXICO.**

Reorganized, January, 1906, as Lustre Mining & Smelting Co.

LUSTRE MINING & SMELTING CO. **MEXICO.**

Office: Pittsburg, Pa. Mine office: Indé, Durango, Mexico. H. D. Gamble, president; J. H. Mueller, vice-president; C. H. Tebbetts, secretary; W. H. Graham, treasurer. Organized January, 1906, under laws of Arizona, with capitalization $5,000,000, as successor of Lustre Mining Co., organized under Iowa laws, with capitalization $1,000,000. Old company ended 1905 with assets of $233,409 and liabilities of $766,926. Was in litigation, February, 1906, certain shareholders alleging irregularity in stock issue of old company, and asking a receiver.

Property is the Mina Magistral, which has a large body of auriferous, argentiferous and slightly cupriferous iron pyrites, carrying 0.5% to 5% copper, 1 oz. silver, and up to $10 gold per ton. Ores are refractory, and ex-

periments with chlorination and cyaniding both failed, after years of work by the best talent, and with a very complete equipment. Plant includes two 90-h. p. engines, burning charcoal, and a 200-h. p. producer-gas plant is to be installed. Property has a 40-stamp mill, 2 Huntington mills, chlorination works and a cyanide plant, installed at a collective cost of $500,000, but all idle, as none succeeded in saving more than 60% of the assay values.

Extensive experiments in pyritic smelting giving successful results, this system has been adopted exclusively, for the treatment of ore. The smelter has two 150-ton McDonald hot-blast furnaces, and the addition of a third of the same capacity is planned. Air for blast is heated by waste heat from furnaces by a specially designed McDonald hot-blast heater. Product is a matte containing principally gold values. West Virginia coke is used for fuel, to the extent of 400 tons monthly. The smelter is said to be saving 95% to 97% of the assay values, and custom smelting was begun, late in 1905.

This company and its predecessors have been operating for nearly 25 years, and, through poor management and trouble with refractory ores, accumulated an immense debt, which has been reduced, during the past two or three years, but is not yet cleaned up. A faction of the shareholders disbelieves thoroughly in the old management, and is endeavoring to secure a change. Notwithstanding poor management, and troubles of an unavoidable nature, in the past, property is regarded as valuable, and as having a promising future.

LYELL COMSTOCK CONSOLIDATED COPPER CO., LTD. TASMANIA.

Offices: 29, Great St. Helens, London, E. C. Eng., and Broken Hill Chambers, Queen St., Melbourne, Australia. Works office: Pillinger, Macquarie Harbour, Tasmania. H. Macdonald, local director; J. J. Muir, mine manager; C. A. Sack, secretary. Organized Dec. 29, 1878, as Mt. Lyell Comstock Copper Co., Ltd., and in March, 1903, absorbed the Tasman Lyell Copper Co., Ltd., and changed name to present title. Capitalization £600,000, shares £1 par; issued, £545,000. Lands, 300 acres, on Mt. Lyell, well located as to strike of ore bodies, and showing a considerable amount of ore of low to medium grades, best grade averaging 4.5% copper. Has a tramway, built to within 2 miles of the mine. Is suffering from lack of funds, and desires absorption by the Mt. Lyell Mining & Railway Co., Ltd.

LYELL PEAKS MINE. TASMANIA.

A prospect, in the Mt. Lyell district of Montagu county, Tasmania.

LYELL PIONEER CONSOLIDATED. TASMANIA.

A prospect, in the Mt. Lyell district of Montagu county, Tasmania.

LYELL THARSIS MINING CO. (NO LIABILITY). TASMANIA.

In liquidation. Lands sold to Mt. Lyell Mining & Railway Co., Ltd.

LYMNI COPPER MINING SYNDICATE, LTD. CYPRUS.

Offices: 32, Great St. Helens, London, E. C., Eng. Mine office: Limassol, Cyprus. L. P. Ford, chairman; Thos. Creswell, F. I. S., secretary; Chas. Christian, mine manager. Organized March 12, 1897, with capitalization £20,000, shares £1 par; issued, £16,542. Lands, 30 square miles, in the

Bellathousa district of Colis, Chrysokhow, Cyprus. Ore occurs as lenses, largest claimed to have a width of 400′ and length of 1,400′. Claimed average ore values is 9% to 10% copper and 3 dwts. silver per ton, from bornite and chalcopyrite. Is developed by 7 shafts, of 150′ to 300′ depth, and by a 2,100′ tunnel. Ore formation apparently is continuous for 3 miles. Mine is not permanently equipped, and company's estimates of values are excessive. Presumably idle.

LYNGENFJORD KOBBERVAERK. **NORWAY.**

Owned by Norwegian-American Copper Mining and Smelting Co.

LYNN CREEK COPPER-GOLD CO., LTD. **BRITISH COLUMBIA.**

Office: 419 Hastings St., Vancouver, B. C. Mine office: Lynn Creek, Vancouver Island, B. C. G. L .Allan, president and treasurer; W. H. Pegram, secretary; W. Thos. Newman, general manager; G. Richardson, superintendent. Organized 1901, under laws of British Columbia, with capitalization $300,000, shares $5 par. Lands, 6 claims, area 200 acres, 8 miles from Vancouver, in the New Westminster district, showing 6 veins, of which 3 range from 5′ to 40′ in width, giving assays up to 8.9% copper, 3 oz. silver and $1 gold per ton. Also has a 4′ to 6′ vein of zinc ore, opened by 2 tunnels, giving a back of 800′ to 1,000′. Mine is claimed to have a large amount of ore in sight, and could ship ore by water to smelters at Crofton, Ladysmith and Van Anda. Idle for several years.

LYONS KYLE GOLD MINING & MILLING CO. **COLORADO.**

Mine office: Central City, Gilpin Co., Colo. Wm. Woods, superintendent. Property is the Tucker mine, carrying gold, silver, lead and copper. Has steam power, 5-stamp mill and a 50-ton concentrator.

MAADEN-KENI MINES. **TURKEY IN ASIA.**

Mine office: Baibourt, Trebizond, Turkey in Asia. Were operated, in a small way, by a Greek syndicate, at last accounts. Presumably idle.

MACBETH LEASING CO. **IDAHO.**

Office: care of Ravenel MacBeth, manager, Salt Lake City, Utah. Mine office: Mackay, Custer Co., Idaho. Property is the mine of the White Knob Copper Co., operated under lease.

MACKEY-BURROUGHS MINING CO. **COLORADO.**

Mine office: Central City, Gilpin Co., Colo. Ores carry gold, silver and copper. Has steam power.

MACKINAW COPPER CO. **IDAHO.**

Mine office: care of E. Daft, manager, Hailey, Custer Co., Idaho. Lands, 3 claims, well timbered and watered, 25 miles east of Hailey and connected herewith by a good wagon-road, at the head of Lost River, in the Lost River Mountains. Property shows a contact vein of 3′ to 5′ width, between limestone and porphyry, opened by a 100′ shaft, showing chalcopyrite assaying up to 15% copper, with quartz gangue.

MACKINAW MINING & MILLING CO. **WASHINGTON.**

Said to have sundry claims in Snohomish county, Washington, showing ore that gives fair assay values in copper and nickel. Idle.

excellent management, and is securing good results. Costs of mining and smelting are very low, net cost of copper delivered in London averaging about £30 per long ton. Annual production was about 1,500 tons fine copper, at last accounts.

JOAQUIN MAIZ y CA. **MEXICO.**

Office and mine: Villa Aldama, Nuevo León, Mexico. C. Robles, manager.

SOCIÉTÉ ANONYME DES MINES DE CUIVRE DE MAJDANPEK. **SERVIA.**

Office: Brussels, Belgium. Mine office: Majdanpek, Servia. Employs circa 500 men. Emile Thorez, chairman; Emile Fromont, administrateur délégué; Charles Brundard, secretary; Leo Zenzes, general manager; Alfred Müller, smelter superintendent; Hugo Hermann, engineer. Organized 1903, under laws of Belgium and Servia, with capitalization 3,000,000 francs. Lands, 16,000 hectares, with trachyte and limestone country rocks, showing native copper, malachite, azurite, chalcopyrite and iron pyrites. Company estimates 600,000 tons of ore in sight, with 250,000 tons blocked out for stoping. Smelter, ½ mile from mine, and connected therewith by a Bleichert aerial tram, has three 40-ton Herreshoff water-jacket blast-furnaces, making blister copper, carrying 96% copper, 14 oz. silver and 1.5 oz. gold per ton. Company is erecting a new smelter of 200 tons daily capacity, to employ the Knudsen pyritic process.

MAJESTIC COPPER CO. **UTAH.**

Office: care of Schirmer, Chapin & Emmons, Boston, Mass. Mine office: Milford, Beaver Co., Utah. Wm. B. Mucklow, president; E. E. Abercrombie, managing director; J. A. Ingols, superintendent. Employs circa 50 men. Organized August, 1904, as successor of Majestic Copper Mining & Smelting Co., with capitalization 400,000 shares; bonds, $200,000. Old company, organized 1900, became insolvent April, 1904, and paid 60 cents on the dollar. Present management took charge facing an indebtedness of $300,000, without treasury stock or credit, but with Samuel Newhouse as managing director, succeeded in rehabilitating the property.

Lands, 120 claims, area 2,450 acres, also an 80-acre smelter site and 1,100 acres miscellaneous lands, in 8 groups, located in 5 districts of Beaver county, Utah, showing about 100 ore bodies, in 20 or more different groups of mines and prospects. In addition to copper the ores carry gold, silver, platinum, lead, cobalt, bismuth, vanadium and uranium. Copper ores include all of the principal oxides, carbonates and sulphides, also occasional native copper, and many of the rarer copper minerals, ores ranging from 2% to 85% copper, with estimated average values of 12% copper, 12 oz. silver and $3 gold per ton, with large percentages of lead, but these figures, made by the former "boom" management, are much too high. There are 18 shafts, of 100′ to 400′ depth, also many tunnels and innumerable test-pits, with circa 6 miles of workings. Former management estimated 1,000,000 tons of ore in sight, with 500,000 tons blocked out for stoping, but these estimates were gross exaggerations, and must have been known to be such when put forth, while stock was being fed to the public. Some of the properties were worked

formerly for silver, but the silver-copper ores at and near surface gave way to copper-silver ores at depth, all ores being more or less auriferous.

The O. K. is the principal mine of the company. Selected shipments of 1,145 tons of O. K. ore gave net returns of $95,000, a shipment of 258 tons in 1901 giving smelter returns of 40% copper, 7.5 oz. silver and $3.80 gold per ton. The O. K. group has 7 claims, opened by a 3-compartment main shaft of 400′, showing a vein ranging up to 28′ width, with considerable development on the 300′ and 400′ levels. Also has an undeveloped ore body apparently about 250′ wide, which is a stockwerk, with stringers carrying high-grade ores. The O. K. has considerable ore blocked out, mainly by the present management.

The Old Hickory group, 9 claims, with a gossan capping circa 250′ wide, above a vein of 40′ to 200′ width, is opened by a short tunnel and by about 50 pits and shafts, deepest 212′, showing ores carrying 4% to 5% copper, with gold and silver values estimated at $2 to $4 per ton. Equipment includes a 34-h. p. Fairbanks-Morse electric hoist, Ingersoll-Sergeant air-compressor and Rand rock drills.

The Harrington-Hickory group, 25 full and fractional claims, has two 400′ shafts and circa 40 pits and shallow shafts showing ore. Main shaft has 3 compartments. This group shows numerous fissure veins intersected by cross-veins, both approximately vertical, and in addition has a series of bedded veins dipping at 30° to 35°, giving three separate intersecting systems of ore bodies. Principal values are in lead, ores giving assays of 2% to 3% copper, 25% to 50% lead and up to 50 oz. silver and $1 gold per ton.

The Vicksburg group, 4 claims, formerly mined for gold, shows three 2′ to 20′ vertical fissures, with mineralized cross-veins, opened by numerous shallow pits and shafts, with a 2-compartment working shaft.

The Hoosier Boy group, 10 claims, has a 250′ vertical shaft, in limestone, showing auriferous and argentiferous copper-lead ores. The Larkspur group, 8 claims, shows a 60′ contact vein between granite and limestone, carrying irregular bunches of high-grade ore. The Copperfield group, 17 undeveloped claims, lies between the O. K. and the Old Hickory mines. The Apex group, 4 claims, adjoins the Old Hickory, and there also is an undeveloped group, known as the Ben Harrison.

The mine has steam, gasoline and electric power, and an undeveloped water power on Beaver river, 35 miles distant, is believed to be capable of generating about 2,000 h. p., and transmitting same electrically to the mine and smelter, at a cost of about $100,000.

The reduction works, at Lewisville, 3 to 8 miles from the various mines, built by the Colorado Iron Works Co., includes a sampling mill and smelter with a 250-ton copper furnace and a 100-ton lead furnace, with Nesmith hot-blast stoves that heat the blast to 800° Fahrenheit, before entering the tuyeres. The smelter building is of steel frame, on stone foundations, and is large enough to accommodate four 250-ton furnaces, with necessary machinery. The townsite of Lewisville was platted by the company. The mines and smelter are served by the Oregon Short Line railway. The build-

ing of a concentrator at the O. K. mine has been considered. On a test run, 1905, under the honest and capable management of Mr. Newhouse, ores gave average returns of 5.1% copper, 3.8 oz. silver and $1.20 gold per ton. This shows how misleading were the smelter shipments and estimates of the former management. Ore is being sent to the Newhouse mill, and, in June, 1906, it was planned to ship 3 tons of concentrates weekly to the Murray smelter, in preference to blowing in the company's own smelter on an inadequate tonnage. The smelter ran for 40 days only, under the previous management, giving only half the claimed duty, and smelted only 5,000 tons of the 500,000 tons claimed to be blocked out for stoping at that time, when it ran out of ore and closed down. The former fiscal agents were Chapman, Mucklow & Bosson, of which firm the present president was a member. This firm is said to have received 40% commission on stock sales. Senator A. B. Lewis also was connected with the promotion. Under competent management the Majestic should make a good mine, in time, and the work of the new company seems to have been done sensibly and economically.

MAJESTIC COPPER MINING & SMELTING CO. **UTAH.**

Succeeded, circa 1904, by Majestic Copper Co.

MALACHITE COPPER CO. **ARIZONA.**

Mine office: Williams, Coconino Co., Ariz. J. F. Durlin, secretary. Lands, sundry claims, north of Williams. Idle.

MALACHITE COPPER-GOLD CO. **CALIFORNIA.**

Office: 209 Homer Laughlin Bldg., Los Angeles, Cal. Letter returned unclaimed from former mine office, Daggett, San Bernardino Co., Cal. S. A. Barrett, president; Jos. B. Cook, secretary; W. E. Steadman, superintendent. Organized under laws of South Dakota, with capitalization $1,000,000, shares $1 par. Lands, 5 claims, area 100 acres, in the Ord district of San Bernardino county, opened by a 165′ shaft, on a 34′ vein carrying an 8′ paystreak, said to assay 7.5% copper and $3 gold per ton. Idle.

MALAGON GROUP. **SPAIN.**

Mine office: Puebla de Guzmán, Huelva, Spain. C. & J. Sundheim, owners; Wm. Guthrie Bowie, manager. Property is a group of government concessions, showing many old workings and excellent outcrops. Idle.

MALLERY MINE. **BRITISH COLUMBIA.**

Sold, circa 1906, to Britannia-West Copper Co., Ltd.

MALONEY-BLUE LEAD COPPER MINING & SMELTING CO. **SOUTH DAKOTA.**

Mine office: Sheridan, Pennington Co., S. D. John Harnan, manager; Philip Harnan, superintendent. Organized 1899, with capitalization, variously reported, of $750,000 or $3,000,000, shares $1 par. Lands, 380 acres, 345 acres patented, showing a vein of 118′ claimed width, surmounted by a heavy gossan, carrying occasional rich oxidized ores containing good copper and gold values. Development is by a 260′ shaft, showing occasional stringers of ore, and a 1,610′ tunnel, showing some arsenopyrite. Developments to date have not shown copper in paying quantities, but payable ore is be-

lieved to exist below the water-level. Equipment includes a steam power plant and air-compressor.

MAMMOTH COPPER CO.

A brazen swindle, perpetrated by the Wm. F. Wernse gang, of St. Louis.

MAMMOTH COPPER MINING CO. **WYOMING.**

Letter returned unclaimed from former mine office, Saratoga, Wyo.

MAMMOTH COPPER MINING CO., OF MAINE. **CALIFORNIA.**

Office: 50 Congress St., Boston, Mass. Mine office: Kennett, Shasta Co., Cal. Employs 200 men. Robert D. Evans, president; A. F. Holden, managing director; Fredk. Lyon, manager; A. P. Anderson, mine superintendent; R. D. Rhodes, smelter superintendent, Jas. Kerwin, assistant smelter superintendent; Geo. K. Fischer, consulting metallurgical engineer. Was organized under laws of Maine, and is a subsidiary corporation of the United States Smelting, Refining & Mining Co., which controls the entire stock issue.

Lands, 14 claims, area 280 acres, also an 80-acre smelter site, and miscellaneous lands giving total holdings of 1,400 acres, 3½ miles from Kennett, on Little Backbone creek, in the Big Backbone district. Lands are well timbered, with numerous mountain streams available for water supply, and the topography is very rugged, the mines being opened near the tops of the mountains. Principal property is the Mammoth mine, showing a prominent gossan outcrop, but holdings also include the Golinsky group, 12 miles from Kennett, bought 1904, with 750′ of workings on a 30′ vein giving fair average assay values. Country rock of the Mammoth mine is rhyolite, somewhat altered, in places, with some slate and considerable porphyry, carrying large flat-lying lenses of ore that is mainly slightly zinciferous chalcopyrite, containing an average of circa 3% copper, 2 oz. silver and 60 cents gold per ton, with about 40% iron and up to 40% sulphur. Development is exclusively by tunnels, of which there are 3, showing several ore bodies, of which the largest is 228′ wide, circa 500′ long, and has been opened to 200′ depth. The mine has about 2,000,000 tons of ore in sight, and extensive diamond drilling is to be done during 1906. Extraction is through tunnels, having ore-bins at the portals, with an ærial tram leading to the smelter. Equipment includes two 15-drill Rand air-compressors, and 28 power drills. Water is piped to the mine and smelter from the Mayflower claim. Buildings at the mine include a smithy, boarding-house, etc. Both mine and smelter are run by electric power, secured, at a low rate, from the Northern California Electric Light & Power Co., the mine using 200 h. p. and the smelter 700 h. p.

The smelter, ½ mile from Kennett, and 2½ miles from the mine, is located on a highly favorable site of 80 acres, once held by the Trinity Copper Co. The plant is entirely of steel, and is the second largest in California, costing, complete, nearly $500,000. Full capacity is circa 1,000 tons daily. All material is handled by gravity, and the plant is operated on three 8-hour shifts.

Ore is taken from the mines and smelter by an ærial tram of 13,200′ length. The line is in two sections, the upper section having a grade of

22% from the mine to the midway station, the tram being operated by gravity, in counterbalance, and power generated by a retarding engine actuates an air-compressor. The lower section has sufficient grade for the loaded buckets to bring back empties. The tram has a capacity of 1,600 tons in 24 hours, carrying 1,100-lb. buckets at intervals of 150', with wooden supporting towers at intervals of 100'.

The buildings of the smelter plant are of steel throughout, and include a bin-house for storing ore, coke and limestone. This is 214' long, and is equipped with 27 scales, for the individual weighing of cars in train-loads. Capacity of the bin-house is 2,500 tons of custom ore and 1,000 tons of fluxing ore, in addition to coke and limestone.

The blast-furnace building, 70x130', has three 325-ton water-jacket blast-furnaces, of which two are run regularly, the third being held in reserve, as the furnaces freeze occasionally, because of the considerable percentage of zinc contained in the ore. The building has two floors, the upper for charging and the lower for tapping.

The power building, 50x80', has 3 blowers, direct-connected to 200-kw. motors, with a capacity of 18,000 cubic feet of cold blast per minute. Fumes from the furnace are taken by individual goosenecks to a hopper-bottom dust-chamber, 280' long, leading to a self-supporting steel stack of 12' diameter and 150' height, set on a concrete base. Underneath the dust-chamber is an electric tram-line, leading to the briquetting-plant, where fines and flue-dust are briquetted for resmelting. Slag is dumped hot, the plant having a slag-line and electric locomotive.

Water is brought to the smelter by a 2-mile flume, and the Northern Pacific railway has a spur to the works. Miscellaneous equipment includes a well fitted machine-shop, office, laboratory and a complete sampling-mill. Fuel is coke, costing $12 per ton, and owing to excess of sulphur in the ore, only about 4% coke charges are required, giving cheap fuel costs. Wood, costing $3 per cord, is used to a slight extent,. Product of the furnace is an auriferous and argentiferous matte of about 40% copper tenor, shipped for reduction to the Utah smelter of the United States company. In addition to treating its own ores, the Mammoth smelter is buying silicious custom ores, for fluxing, from Utah and Nevada mines, including rich gold-silver ores from the Tonopah camp, and probably will take Oregon ores to a considerable extent also.

The first furnace of the smelter was blown in, October 6, 1905, and a second and third shortly thereafter. Early in 1906 it was planned to double the capacity of the smelter, which, in June, 1906, was producing at the rate of about 1,250,000 pounds fine copper per month. The property is being handled in a manner that leaves little ground for criticism or suggestion, and is certain to become, within a comparatively short time, one of the large copper producers of the United States.

MAMMOTH COPPER & SMELTING CO. **ARIZONA.**

Letter returned unclaimed from former mine office, Red Rock, Pinal Co., Ariz. Described in Vol. IV.

MAMMOTH GOLD MINING CO. **COLORADO.**

Office: 1104 Marquette Bldg., Chicago, Ills. Mine office: Central City, Gilpin Co., Colo. W. H. Paul, superintendent, at last accounts. Ores carry gold, silver and copper. Has steam power.

MAMMOTH HILL GROUP. **ARIZONA.**

Mine office: Safford, Graham Co., Ariz. Idle.

MAMMOTH LODES MINING CO. **BRITISH COLUMBIA.**

An Oregon corporation, owning the Colorado group of claims, in the Cascade Mountains, Yale district, British Columbia. Veins are claimed to run from 40′ to 250′ in width, and to be traceable for more than two miles, and it is claimed that smelting tests have given 15% to 20% copper and $12 gold per ton, these figures being, in themselves, ample evidence of their own untruthfulness or of the unfair nature of the "test."

MAMMOTH MINE. **ARIZONA.**

Letter returned unclaimed from former mine office, Dragoon, Ariz.

MAMMOTH TUNNEL & MINING CO. **COLORADO.**

Office: 403-331 Fourth Ave., Pittsburg, Pa. Mine office: Silverton, San Juan Co., Colo.

MAMMOTH MINING CO. **UTAH.**

Office: Hooper Blk., Salt Lake Ctiy, Utah. Mine office: Mammoth, Juab Co., Utah. Employs 125 men. Samuel McIntyre, president and general manager; Samuel McIntyre, Jr., vice-president and superintendent; R. M. Wilkinson, secretary. Organized under laws of Utah, with capitalization $400,000, shares $1 par, and, in March, 1906, planned reincorporation, under laws of Nevada, with capitalization $1,000,000, shares $1 par. Incorporation in another state will give the advantage of trial in the Federal courts, in case of litigation.

The Mammoth mine, in the Tintic district, is opened to a depth of circa 1,200′, and is a considerable producer of auriferous and argentiferous lead and copper ores, values being mainly in silver and lead. Has steam power and a 60-stamp mill. For 1904, receipts from all sources were $309,370, with net earrnings of $105,340, from which dividends of $118,537 were paid.

MANASSAS-GAP COPPER-MINE, INC. **VIRGINIA.**

Office: 25-33 Broad St., New York. Mine office: Reager, Rappahannock Co., Va. Geo. B. Wright, president; Hon. John S. Wise, vice-president; Henry P. Porter, secretary; Powhattan Weisiger, treasurer; R. R. Crook, superintendent. Organized Oct. 30, 1903, under laws of Virginia, as a reconstruction of the Carter Copper Co., with capitalization $999,000, shares $1 par. Lands, 700 acres, freehold, including about 400 acres of timber land, in Fauquier county, Virginia, showing a volcanic formation, carrying two contact veins between Cambrian sandstone and Silurian slates, ranging 3′ to 11′ in width, said to give average assays of 5% copper, 10 oz. silver and $4 gold per ton, from malachite, bornite and chalcopyrite, associated with occasional native copper. Has about 600′ of underground openings. Two railroads are within 3 and 6 miles, respectively. Idle.

MANCAYAN COPPER SYNDICATE, LTD.

Voluntarily wound up, August, 1902.

MANCHESTER ZINC & COPPER CO., LTD.

Voluntarily wound up, April 15, 1901.

MANHATTAN COPPER MINING CO. **ARIZONA.**

Merged, 1902, in Troy-Manhattan Copper Co.

MANHATTAN COPPER MINING & MILLING CO. **NEVADA.**

Office: care of Hon. A. B. Lewis, president, 100 Broadway, New York. Mine office: Pioche, Lincoln Co., Nev. E. F. Freudenthal, manager. Was controlled, at last accounts, by the Nevada-Utah Mines & Smelters Corporation, and apparently succeeded the Manhattan Gold & Copper Mining Co. Lands, 2 groups, one east of Pioche and one in the Stampede Gap section. The Pioche group includes the Revenue, Telephone and Alps mines, with shallow development, by 100′ and 140′ shafts, showing ore giving good assay values in gold and silver. The Stampede Gap mine is opened by 2 tunnels, obtaining a maximum depth of 400′, with circa 2,000′ of openings, and is sinking a new working shaft, equipped with 12-h. p. Fairbanks & Morse gasoline hoist. Property shows auriferous and argentiferous copper and lead sulphides.

MANHATTAN DEVELOPMENT CO. **ARIZONA.**

Office: Post Office Blk., Houghton, Mich. Mine office: Paradise, Cochise Co., Ariz. J. H. Rice, president; W. G. Rice, secretary and treasurer; preceding officers, Thomas F. Cole, Nathan M. Kaufman, Samuel R. Kaufman, Allen F. Rees and Norman W. Haire, directors; Fred. W. Hoar, superintendent. Organized March, 1905, under laws of Arizona, with capitalization $200,000, shares $10 par; $5.50 paid in. Lands, 37 claims, area 600 acres, fully paid for, in the California district, carrying upwards of 2 miles of the outcrop of a mineralized zone lying west and north of the holdings of the Chiricahua Development Co. Development is by several shallow shafts, deepest 80′, and a 450′ crosscut tunnel, latter showing leached ore and a little high-grade ore, with indications of permanent values at greater depth. Management is good, and property is considered promising.

MANHATTAN GOLD & COPPER MINING CO. **NEVADA.**

Apparently succeeded, circa 1905, by Manhattan Copper Mining & Milling Co.

MANHATTAN GROUP. **ARIZONA.**

Letters returned unclaimed from former mine office, Cave Creek, Ariz.

MANICA COPPER DEVELOPMENT CO., LTD. **MOZAMBIQUE.**

Office: Finsbury Pavement House, London, E. C., Eng. M. F. Armstrong, chairman; J. S. Park, mine manager; W. E. Lane, secretary. Organized May 26, 1902, with capitalization £150,000, shares £1 par; issued, £115,000. Lands, 411 claims, area circa 900 acres, in Manicaland, Mozambique. Three copper outcrops have been located, one of which, opened to depth of 200′, is said to be promising.

MANICA COPPER EXTENSION, LTD. **MOZAMBIQUE.**

Registered, 1903, with capitalization £1,000. Moribund.

MANICA EXPLORERS, LTD. **MOZAMBIQUE.**

Offices: 615, Salisbury House, London, E. C., Eng. Organized Jan. 23, 1896, under laws of Guernsey, as reconstruction of Western Explorers, Ltd., with capitalization £100,000, shares £1 par; issued, £52,400. Lands include 200 copper claims, 770 gold claims, 16 acres of townsite lands and circa 25,000 acres of miscellaneous lands, said to be rubber-bearing

MANILA GROUP. **ARIZONA.**

Mine office: Paradise, Cochise Co., Ariz. Lands, sundry slightly prospected claims, about 3 miles from the Chiricahua Development Co.

MANILLA MINING CO. **ARIZONA.**

Office: care of N. L. Houston, manager, Peoria, Ills. Mine office: Ft. Huachuca, Cochise Co., Ariz. Lands, sundry claims in the Huachuca Mountains, opened by a 220′ shaft, showing argentiferous copper and lead sulphides. Has a steam plant, with hoist, pump and air-compressor.

MANITOU MINING CO. **MICHIGAN.**

Office: 12 Ashburton Place, Boston, Mass. Operating office: Calumet, Mich. Mine office: Delaware Mine, Keweenaw Co., Mich. Quincy A. Shaw, Jr., president; Rudolph Agassiz, vice-president; preceding officers, Alexander Agassiz and Francis L. Higgison, directors; Jas. MacNaughton, general manager; Geo. A. Flagg, secretary and treasurer; Will J. Penhallegon, superintendent. Organized June 26, 1905, under laws of Michigan, with capitalization $500,000, shares $25 par.

Lands include the old Delaware mine, also known variously as the Conglomerate and Lac La Belle mine. The Delaware tract contains circa 3,700 acres of mineral lands, and upwards of 17,000 acres of miscellaneous lands, with a water frontage of 10 miles on Lake Superior, and the entire frontage on Lac La Belle. The property has been tested by diamond drill borings, and an amygdaloidal bed, identified as the Kearsarge lode, has been located and 3 pits, deepest 65′, sunk thereon, giving an encouraging showing of copper. The Kearsarge bed is 7,800′ southward of the base of the greenstone bed. Principal development is on the amygdaloid bed previously known as the Montreal River lode, lying 1,770′ south, on surface, of the base of the greenstone bluff. A shallow shaft, sunk circa 1899, in the middle of the Southwest quarter of Section 15, Town 53 North, Range 30 West, has exposed this lode, and this shaft had been deepened to circa 100′, at the end of 1905. The lode dips at about 28°, and is 12′ to 14′ in width, showing copper in unusually promising quantities.

The old Delaware mine, opened on the Allouez conglomerate bed, has 4 shafts of 300′ to 900′ depth. The Allouez lode underlies the greenstone and dips northward at an angle of 25° 30′. The mine on the conglomerate was tested extensively, at a cost of about $1,700,000, by the former owners, but was not found profitable.

MANITOU MINING & MILLING CO. **COLORADO.**

Letter returned unclaimed from former mine office, Bonanza, Colo.

"MANN" GROUP. **ARIZONA.**

Office and mine: care of Otto W. S. Schley, owner, Vail, Pima Co., Ariz.

Lands, 4 claims, area 80 acres, in the Helvetia district, 9 miles southeast of Vail and 28 miles southeast of Tucson, formerly held by the Bradford Development Co., showing a formation of Carboniferous limestone, intruded by porphyry dikes, latter considerably altered, showing extensive outcrops of oxide and carbonate ores, succeeded at a little depth by sulphides. Property shows several veins of 6″ to 5′ width, and is opened by a 2-compartment shaft of 105′, in porphyry, showing stringers of quartz carrying copper sulphides. Shipments of 100 tons, to the El Paso smelter, gave returns of 9.5% to 17% copper, 8 oz. to 16 oz. silver and $8.50 gold per ton. The ore carries an excess of iron, and smelts readily.

MANSFELD'SCHE KUPFERSCHIEFERBAUENDE GEWERKSCHAFT. GERMANY.

Mine office: Eisleben, Prussian Saxony, Germany. Dr. Ferdinand Zirkel, Dr. Dittrich and Dr. Paul Wachler, executive committee; Herman Schrader, smelter superintendent. Organized 1852, as a consolidation of numerous independent operators, and reorganized, April, 10, 1876, with 69,120 shares. Employs 16,192 mine workers, and 2,505 smelter workers, with a total force of 22,262 men.

The Mansfeld copper mine was opened A. D. 1199, and, under the Counts of Mansfeld attained a high state of development, and was immensely profitable, during the Fourteenth and Fifteenth Centuries, but the industry almost suffered extinction during the Thirty Years' War. Activity was resumed in 1671, when the right of working the mines was declared free, this resulting in the building up of a great number of small independent operators. The present company was first formed, in 1852, as a consolidation of the various small mine operators and smelters, and the merging of many small interests has resulted in an increase of production, from 2,660 metric tons in 1867, to 18,882 metric tons fine copper in 1904.

The principal ore is slightly argentiferous chalcopyrite, associated with limited quantities of nickel and cobalt ores, occuring as speiss, disseminated in very fine grains through the kupferschiefer, a fine-grained bituminous shale. The kupferschiefer lies nearly horizontally, with a dip of 5° only, and ranges from 2′ to 3′ only in thickness, but covers nearly 200 square miles. Lying just below the kupferschiefer is an arenaceous shale, carrying chalcopyrite, and a limited quantity of copper carbonates. Owing to the thinness of the bed, and the great age and extent of the workings, it is necessary for miners to work on their sides, bellies or backs, as in coal mines, wearing boards upon their trunks and thighs, in order to protect themselves from the rock floors. Owing to the great age and extent of the workings, the headings usually are 2 to 4 kilometers from the shafts, hence the actual mining is done under considerable disadvantages. The workings are of vast extent, and there are scores of old and abandoned shafts. Present mining operations are through 9 hoisting shafts, with a large number of shafts for water and ventilation. Among the new shafts are the Johannes, at Hohenthal, and the Hermann, at Helbra. The mines have six duplex Weisse & Monski pumps, and a full equipment of hoisting engines and general mining ma-

chinery. The company maintains independent machine shops, capable of building and repairing any mining or pumping machinery in use.

The Mansfeld has numerous reduction works, including 4 smelters for raw ores, 2 roasting smelters with acid plants, 2 matte smelting works, 2 refining furnaces, and one electrolytic refinery with desilverizing plant. The various works have a total of 20 reverberatory furnaces. The principal smelters are the Krughütte, at Eisleben, with 4 furnaces; the Kochhütte, at Helbra, with 4 furnaces; the Eckhardthütte, at Leimbach, with 4 furnaces, and the Kupferkammerhütte, at Hettstedt, with 3 furnaces. All of these furnaces are of circular shaft type, with forehearths, and use cold blasts, except the Kupferkammerhütte, where hot blast is employed to some extent. The Saigerhütte is a refining plant, and the Gottesbelohnunghütte has 10 reverberatory furnaces. The Krughütte, near the mine, is equipped with Steinbeck circular multiple-hearth automatic pyritic calciners, which use no carbonaceous fuel, except for preliminary charges. The Eckhardthütte has one lead stack, producing a silver-lead matte, and making a little nickel speiss from resmelted fluedust. The Eckhardthütte has 72 kilns and 5 lead acid chambers, and the Kupferkammerhütte has 82 kilns and 6 lead acid chambers, these works making 2,212 metric tons of 50° Beaumé sulphuric acid, in 1903, from the fumes of the ore and matte treated.

The method of reduction followed at the Mansfeld is by heap-roasting and calcining in shaft-furnaces. Roast-heaps are built about 60 metres long, 5.5 m. broad at the bottom and 3 m. broad at the top, and only about 1.50 m. to 1.75 m. high The only fuel used is a little brushwood, at the edges and bottoms of heaps, and each heap is roasted 4 to 6 weeks. If the ore, as produced, carries any fines, these are screened, briquetted and added to the roast-heaps. The roasting reduces the ore 8% to 20% in weight, and the roasting is more for the elimination of carbon dioxide and bituminous matter, than to throw off sulphur, the latter running only 2% to 5% in the raw ore, while the bituminous matter ranges 10% to 17%, and CO_2 is 7% to 13%. There are 4 roast-stalls near the shafts, and at the furnaces the first-fusion product is a matte carrying circa 40% copper and 0.25% silver. This matte is broken up and roasted in 2 calcining kilns, and the roasted matte, with the addition of 5% to 10% raw matte, is smelted, in reverberatory furnaces, to white metal carrying 74% to 75% copper and 0.45% to 0.50% silver. The slags from the white metal carry 9% to 15% copper, and are returned to the shaft-furnaces. Slag is utilized extensively, in the manufacture of slag-brick and paving blocks.

The desilverizing plant, at the Saigerhütte, operates on the Ziervogel method, roasting the matte and retaining the silver as a sulphate, which is dissolved in water and the solution run over metallic copper, which precipitates the silver, the cement silver so secured being pressed and resmelted to metal .999 fine. The final furnace product, after the extraction of the silver, is a blister copper 99.7% to 99.8% fine. In 1903 the Mansfeld smelters treated 686,354 metric tons of ore, making therefrom 49,179 tons of low-grade matte, the average tenor of the ore being 28.19 kgs. copper and 0.156 kgs. silver per

ton. Production, 1904, was 41,629,349 lbs. fine copper, and in 1905 was 43,824,141 lbs. fine copper.

In addition to its mines and smelters, the Mansfeld company has extensive industrial undertakings of a collateral and subsidiary nature, the more important of these being extensive coal mines and coke works at Hamm, Westphalia, also alkali deposits and works. The company is handled with great technical skill, and the Mansfeld is an excellent object lesson in the management of a large, low-grade mine.

MINA MANTO VERDE. **CHILE.**

A promising property, in the Tierra Amarilla district of Chile, under private ownership.

MARAVILLA COPPER CO. **ARIZONA.**

Letter returned unclaimed from former office, Providence, R. I. Mine office: Safford, Graham Co., Ariz. Wilbur H. Powers, president; S. S. Campbell, manager; Chas. B. Spaulding, superintendent. Lands, sundry claims, in the Gila range, circa 10 miles north of Solomonville, including the Lone Star mine, opened by a 500′ main shaft, showing a 5′ vein of sulphide ore, of high grade at bottom, carrying copper, silver and gold values, latter small. Is said to have a considerable showing of 8% to 10% sulphide copper ore. Idle for some years.

MARBLE BAY MINING CO. **BRITISH COLUMBIA.**

Mine sold to the Tacoma Company.

MARGUERITA MINE. **CALIFORNIA.**

An old and idle property, near Almaden, California, operated circa 1865.

MARICOPA COPPER CO. **ARIZONA.**

Letter returned unclaimed from former office, St. Louis, Mo.

MARICOPA COPPER MINES CO. **ARIZONA.**

Letters returned unclaimed from former mine offices, Wickenburg and Morristown, Maricopa county, Arizona.

MARIETTA GOLD MINING CO. **IDAHO & WASHINGTON.**

Office: care of Lawson Investment Co., 60 State St., Boston, Mass. M. E. Lawson, president and general manager; H. C. Lawson, secretary. Organized under laws of Washington, with capitalization $1,000,000, shares $1 par. Lands include gold claims in Ferry county, Washington, and the Atlas group of 5 claims, area 100 acres, in the Stevens Peak district of the Cœur d'Alenes, Shoshone county, Idaho. Development is by a 250′ tunnel, claimed to show a 20′ ore body, averaging $50 per ton in copper, gold and silver values. Presumably idle.

MINA MARIPOSA. **MEXICO.**

Office and mine: care of Thomas F. Rowe, Tapalpa, Jalisco, Mex. Lands, sundry claims, circa 9 miles southwest of Tapalpa, showing a 3′ vein giving assays of 7% copper and 1 oz. gold per ton.

MARIPOSA MINE. **ONTARIO.**

Letter returned unclaimed from former mine office, Massey Station, Algoma, Ont. An idle prospect, adjoining the Copper Queen of Ontario.

MARITIME COPPER & REDUCTION CO. **NEW BRUNSWICK.**

Mine office: Goose Creek, St. John Co., N. B. An old property showing a large body of low grade ore. Idle since 1902.

MARKEEN COPPER CO. **ARIZONA.**

Dead. Lost lands, 1903. Fully described in Vol. IV.

MARQUETTE & ARIZONA MINING CO. **ARIZONA.**

Office: Marquette, Mich. Mine office: Bisbee, Cochise Co., Ariz. Emil Marks, president and general manager; Jos. J. Wirtz, secretary. Organized Dec. 6, 1902, under laws of Arizona, with capitalization $500,000, shares $5 par. Lands, 37 claims, area 740 acres, adjoining the Copper Glance on the east. Has shafts of 28′ and 560′, also sundry pits, showing copper stains and iron. Tract has a heavy conglomerate capping, much similar to that of the Copper Glance. Main shaft has 2 compartments, substantially timbered, passing through limestone showing considerable iron, and is quite wet, much of the shaft showing country rock assaying about $2 gold per ton. The shaft has short north and south drifts, on the 400′ level, and one short drift on the 145′ level. Has a 35-h. p. hoist. Idle since 1903.

ANGEL MARQUIEQUL **BOLIVIA.**

Mine office: Coro Coro, La Paz, Bolivia. Works a conglomerate carrying native copper. Has steam power.

MARTHA WASHINGTON MINE. **UTAH.**

Mine office: Silver City, Juab Co., Utah. Ores carry mainly silver values, with 2% to 3% copper.

GRUBE MARTINI. **GERMANY.**

Office: care of W. Von Vloten, Hoerde in W., Rheinprovinz, Germany. Has spathic iron ore and chalcopyrite, output being mainly iron, of which the production averages about 7,000 tons yearly. Has steam power and employed 60 men, at last accounts.

MASCOTA MINING CO. **MEXICO.**

Office: Chicago, Ills. Mine office: Talpa, Jalisco, Mexico. Harry S. Church, vice-president and general manager. Lands, 32 pertenencias, 9 miles west of Talpa, in the cañon of the Ocotlán river, known as the Ocotlán mine. Property is heavily timbered, furnishing fuel for ordinary mine operations. Mine shows a vein of 20′ to 60′ width, with a paystreak of 4′ to 20′, carrying auriferous and argentiferous copper and zinc sulphides. Development is by tunnels and shafts, showing a considerable quantity of ore. Property has been worked previously, by German and Mexican companies. Power is furnished from the Ocotlán river. An experimental leaching plant was built in 1905. Smelter has roasting furnaces and a water-jacket blast-furnace. Heretofore the zinc values have been lost, but an effort will be made to save them. Property is considered promising.

MASCOT MINING CO. **ARIZONA.**

Office: 1318 Majestic Bldg., Detroit, Mich. Mine office: Willcox, Cochise Co., Ariz. Dr. B. R. Hoyt, president; W. C. Rohms, vice-president; J. A. Zahn, treasurer; D. D. Jayne, secretary; preceding officers and F. F. Fehlig, directors; C. W. Courtney, superintendent. Capitalization $1,000,000,

shares $1 par; issued, $229,000. Lands, 23 claims, area 460 acres, lying circa 40 miles northeast of Willcox, in the Montezuma and Clark districts, in the western part of Graham county, 3 claims being owned outright and 20 held under a $37,000 bond and lease, on which $31,000 has been paid. Lands are in 4 groups, located within 4 miles of each other. The Gold Cord group shows a vein of 6" to 22" width, opened to depth of 170', carrying 1% to 3% copper and high gold values, giving total assay values of $49 to $94 per ton, with circa 1,300' of openings. The Iron Bell group, 9 claims, has a shallow shaft, showing ore assaying 1% to 16% copper and circa $20 gold per ton, with small silver values, and prospects of better copper values at depth. A group of 5 claims, 1½ miles from the Gold Cord, shows a 4' vein opened to depth of 85', giving assay values of $20 to $40 per ton in lead, silver and gold. Ores are malachite, azurite and chalcocite. Property has steam power, an engine-house, smithy, boarding-house and bunk-house, and is 22 miles from the nearest railroad point, Fort Thomas, on the Gila Valley, Globe & Northern railway.

MASCOT TUNNEL CO. **COLORADO.**

Mine office: Turret, Chaffee Co., Colo. Elmer E. Briggs, superintendent, at last accounts. Ores carry gold, silver and copper.

MASHELL COPPER MINING & REDUCTION CO. **WASHINGTON.**

Office: 437 Banigan Bldg., Providence, R. I. Mine office: Etonville, Pierce Co., Wash. C. J. McCormick, president; J. M. Mansfield, secretary and treasurer. Limited development work has shown several small veins, giving good assay values in gold and copper. Idle for several years.

MASON & BARRY, LTD. **PORTUGAL.**

Offices: 87, Cannon St., London, E. C., Eng. Mine office: Pomarao, Alemtejo, Portugal. Sir Francis Tress Barry, chairman; James Francis Mason, J. P., deputy-chairman; Edward O. Barry, secretary; W. Neville, mine manager. Organized June 2, 1892, (as a reconstruction of company of same name organized June, 1878,) with capitalization £210,000, shares £1 par; issued, £187,172. Capitalization has been reduced from £1,05 ,000, by returning to shareholders £1 per share, on four different occasions. Has paid dividends regularly, since organization, these ranging from 3s. to 13s. per annum, dividends for the last few years having been as follows: 1901, 13s.; 1902, 11s.; 1903, 7s.; 1904, 7s; Total profit for year 1904 was £74,932. The company has a staff pension fund.

Property is the San Domingos mine, originally opened and extensively worked by the Romans, operated by present company, and its predecessor, since 1858. Mine is opened for a width of about 200' and a length of about 2,000'. Product is cupriferous pyrites, carrying slightly under 1% copper, and 50% sulphur, principal values being in the sulphur rather than in the copper. After being burned for sulphur, the cinder is leached for copper values. The copper contents of the ores are decreasing slowly, but steadily.

The mine has 700,000 tons of ore in heaps, containing circa 4 000 long tons fine copper. Reserves of ore, at end of 1904, were 5,250,000 ong tons,

down to the 180 metre level, with every reason to believe in the continuance of large ore bodies at much greater depth. Considerable trouble has been experienced from fire, in the west end of the 150-metre level, and the burning portion of the mine has been walled off. Production, 1905 was 6,088,320 lbs. fine copper. Property is carefully managed, and has a long and honorable record as a producer.

MASON VALLEY COPPER CO. **UTAH.**

Office: presumably Salt Lake City, Utah.

MASSASOIT GOLD & COPPER CO.

Office: 7 Water St., Boston, Mass.

MASSASOIT MINING CO. **UTAH.**

Office: care of E. V. McGarrick, president, Salt Lake City, Utah. Mine office: Bingham Canyon, Salt Lake Co., Utah. Name was changed, 1905, from Red Wing Extension Mining Co., to present title. Lands, 120 acres, adjoining the Red Wing, showing a 4′ vein, giving average assays of circa 0.5% copper, 7% lead and 8.5 oz. silver per ton. Mine is said to show about 60,000 tons of ore.

MASS CONSOLIDATED MINING CO. **MICHIGAN.**

Office: 1105–6 Beacon St., Boston, Mass. Mine office: Mass, Ontonagon Co., Mich. Employs circa 300 men. Chas. A. Lamb, president; J. Walter Davis, vice-president; Wilfred A. Bancroft, secretary and treasurer; Jas. M. Wilcox, superintendent; preceding officers, F. W. Hunton, Chas. W. Riley and Geo. A. W. Dodge, directors; Joseph Satterley, mill superintendent; W. A. Brown, clerk; E. Fenner Douglass, engineer; Thomas Hall, mining captain; Truman G. Edwards, auditor; Samuel V. Rawlins, master mechanic at mine; Jas. Richards, master mechanic at mill.

Organized 1899, under laws of Michigan, with capitalization $2,500,000, shares $25 par; paid in, $19. Has 2,563 shares in the treasury. Annual meeting, second Thursday in March. American Loan & Trust Co., Boston, registrar; Old Colony Trust Co., Boston, transfer agent.

Official returns to the state of Michigan, as of date Jan. 1, 1905, disclose the following figures:

Amount of cash paid in on capital stock	$1,217,000.00
Amount paid in by conveyance of property	555,000.00
Entire amount invested in real estate	581,067.61
Amount of personal estate	292,776.79
Amount of floating debt	48,335.96
Amount due company	66,962.19

Mineral lands, area circa 2,400 acres, are in a very irregular but fairly compact tract, in Sections 33, 34 and 35, T. 51 N., R. 38 W., and in Section 1, T. 50 N., R. 39 W., bounded on the north by the Union, Adventure and farm lands, on the east by the Adventure, Toltec and Evergreen, on the south by the Flint Steel and the Knowlton mine of the Adventure, and on the west by the Flint Steel, Adventure and St. Mary's Mineral Land Co. Lands include three old mines, the Ridge, Mass and Ogima, also two old prospects, the Merrimac and Hazard, joint production of which, under pre-

vious managements, was 5,565 tons, 1,023 lbs. fine copper. The Ridge mine, operated 1850–1874, made 2,567 tons, 449 lbs. copper, and paid dividends of $100,000. The old Mass mine, opened 1856 and worked intermittently until 1886, secured a total output of 2,507 tons, 266 lbs. copper, and the Ogima, opened 1860 and closed 1868, made 491 tons, 308 lbs. copper. The Merrimac and Hazard were early-day explorations, without recorded production. These five properties are described, in detail, in Vol. II.

The Mass tract carries six of the seven cupriferous amygdaloids of the Evergreen belt, these varying greatly from point to point, but averaging about 10′ width, with a sharp bend in their strike, this varying from N. 32° E., on the north, to N. 37° E. at the southern boundary. The dip of the lodes varies from 38° at the Ridge to 47° at the old Mass mine. The copper-bearing beds of the Mass Consolidated are as follows, from north to south:

(1.) Knowlton. Carries heavy copper and stamp rock.

(2.) Mass. Lies 140′ south of the Knowlton and carries a little heavy copper and stamp rock.

(3.) North Butler. Lies about 75′ south of the Mass bed, and is wide and fairly mineralized in places.

(4.) Butler. Lies about 200′ south of the North Butler, is 12′ to 35′ wide, and very bunchy, carrying mainly stamp copper, with occasional masses.

(5.) Ogima. Lies about 100′ south of the Butler. Is mainly a stamp lode, with some barrel-work and occasional masses. Is 10′ to 25′ wide but shows little good ground.

(6.) Evergreen or Ridge. Lies about 250′ south of the Ogima and is the best lode of the property, ranging 4′ to 40′ in width, and usually being richest where widest. Is very bunchy, but shows some excellent stopes, yielding heavy copper and stamp rock.

The Mass has openings on all of its copper-bearing beds, and rock is hoisted through the nearest shaft, lodes being connected by crosscuts on various levels. The Mass carries the outcrop of the lodes of the Evergreen belt for about 1½ miles.

"A" shaft, formerly known as the Ridge, has 3 compartments, and is sunk to a depth of 1,600′, on the Evergreen lode, and connected with the Butler lode by crosscuts on several levels. The Evergreen lode runs narrower here than in "B" shaft, averaging only 8′ to 10′ width, but shows much rock of excellent grade. The shafthouse was burned, 1905, and has been replaced by a head-frame. Rock from this shaft goes by gravity-tram, over an 875′ trestle, to the rockhouse at "B."

"B" shaft, 875′ southwest of "A", is old No. 3 Ridge shaft, cut down to 2-compartment size, and is bottomed at a depth of 1,700′. The levels are of varying depths, owing to the old workings having 60′ levels, while some of the newer levels at the bottom are 135′ apart. Deep levels permit a considerable saving in drifting through poor ground, and sub-drifts can be run wherever needed. "B" shaft is on the Evergreen lode, upon which the

major portion of the openings have been secured, but the Butler has been reached by crosscuts on numerous levels, and shows some good stopes, and the North Butler is supplying some fair stamp and barrel copper. The Knowlton bed has been opened also, by a crosscut on the 7th level, and shows good stamp-rock and considerable heavy copper. The main reliance, however, is upon the Evergreen, which is a strong amygdaloid, with plainly defined walls and a dip of 43°, showing some good stopes, of 20′ and 25′ width. The Evergreen, while exceedingly bunchy, and carrying heart-breaking stretches of almost barren ground, shows beautiful stopes occasionally, and the average copper contents, per fathom of ground broken, probably exceed the average of any but the best amygdaloids worked in Houghton county. The shaft-rockhouse at "B" is of wood, iron-sheathed, 48x65′ and 80′ high, equipped with a steam-hammer, two 22x28″ Blake crushers, and a 12x24″ Nordberg engine.

"C" shaft, 2,148′ southwest of "B", and with collar 100′ higher, is 600′ deep. It is the old Ogima shaft, cut down, retimbered and deepened, and is sunk on the Butler lode, with crosscuts to the Evergreen bed. Eventually the workings tributary to "C" will be connected, by drifts and crosscuts, with "A" and "B" shafts. The Butler lode makes a fair showing in "C" shaft, and at the end of 1905 this shaft was producing circa 150 tons of stamp-rock daily. The shaft is reached by a railroad spur, and is to have, during 1906, a 40x55′ shaft-rockhouse.

"D" shaft is a mere pit, lying circa 800′ southwest of "C".

Some diamond drilling was done, during 1905, on the belt of mineral beds parallelling the Evergreen belt and lying circa 2,000′ north of the Knowlton lode. This belt includes the Minnesota conglomerate, Calico amygdaloid, and the branch veins associated with these two beds, as opened at the Michigan mine. A shaft has been sunk 130′ on the Minnesota conglomerate, and a crosscut is being driven from the bottom to the Calico amygdaloid. This should cut the Branch vein of the Michigan mine, if it carries so far. The copper showing in the Minnesota shaft is considered encouraging.

There are a number of old shafts, the 450′ main shaft of the old Mass mine proper having 7 levels, opened on the Knowlton lode. This was pumped out in 1901, and the showing pronounced satisfactory. The Ogima lode has been opened at several points, by crosscuts from "A" and "B" shafts, and was found bunchy, though showing good stopes.

The mine, as a whole, is notably rich in mass copper, and carries considerable silver values, the ground ranging from very rich to absolutely barren. All rock selection is made underground, and culls used for filling. During 1905 the mine made 9,208′ of openings, as compared with 3,020′ in the preceding year. The number of drills running was increased from 32, at the beginning, to 45 at the close of 1905.

"A" and "B" shafts are operated from a central power-house, 48x150′, of wood, iron-sheathed. The hoist is a 24x48″ Allis-Chalmers duplex, with 10′ drums, having 11′ faces, grooved for 1½″ cable, and good for one half-mile depth, operating two six-ton skips in counterbalance, one in each shaft.

There are two 250-h. p. Stirling water-tube boilers, a 50-drill Rand two-stage cross-compound air-compressor, and a 75-kw. dynamo furnishing electric light.

In addition to the usual mine buildings, there are about 60 dwellings, some new, but mostly old buildings thoroughly remodeled. The company also has a townsite, Mass City, which is the terminus of the Mineral Range railroad, and a station on the C. M. & St. P railway. This town has a number of business houses.

The Mass mill is at Keweenaw Bay, on an arm of Lake Superior, at the junction on the Mineral Range and Duluth, South Shore & Atlantic railways, 16 miles south of Houghton and 34 miles northeast of the mine, with ample sand-room, deep water and immunity from heavy seas. The mill, built by the Wisconsin Bridge & Iron Co., of steel frame on stone foundations, was enlarged, 1905, by a 22′ addition, to 90x232′. Equipment includes two Nordberg stamps, having vertical mortar-grates supplied with automatic hydraulic cleaning devices. Each head has a nominal stamping capacity of about 525 tons daily, with actual daily average duty of 480 to 500 tons. It is planned to compound one head, and to install auxiliary crushing-rolls for oversize. A Parnell-Krause atmospheric stamp of small size reduces oversize material from the stamp-mortars. The Mass uses one stamp, and the other is leased to the Michigan mine, but the latter has been notified that the Mass will require both stamps after Sept. 1, 1906.

The 30x60′ boiler-house, at the mill, is of wood, with iron sheathing and truss roof, housing two 225-h. p. Stirling water-tube boilers. Ashes and cinders are washed into the lake, through a launder. The 40x70′ pump-house has a 16,000,000-gallon Nordberg vertical pump, fed from a 12x30′ well, with bottom 6′ 6″ below mean water-level, connected with a tunnel running 300′ under the bed of the bay to the intake. A 1,000′ wharf, also serving as a breakwater, has 18′ of clear water at its end, equipped with three towers and derricks, capable of unloading coal vessels at the rate of 900 tons daily. Coal is taken from the wharf, in 3-ton cars, by a 14x20″ hoist, to a 1,500′ trestle of 20,000 tons storage capacity. There also is a 30x40′ warehouse, with office in front, a smithy, machine shop and about a dozen dwellings, on a townsite platted by the company, this also having several business buildings.

The Mass began production with inadequate openings. On paper the total feet of openings looked large, but deducting therefrom the unproductive shafts, and about a mile of crosscuts, the total available openings were entirely inadequate, for so bunchy a mine. That the Mass was able to maintain a considerable and fairly steady production, with so little ground opened ahead of actual stoping, speaks well, both for the mine and its management. The operations of 1904 showed a small net profit, but realizing that the mine required greater development, a $2 assessment was levied. Operations for 1905 entailed expenditures, including the outlay of $115,460.65 for construction account, of $391,915.30, and income, from production and interest, was $334,534.12. The income of $60,919.47 received from the Mich-

igan, for milling, was deducted from milling costs of the Mass, reducing same to $19,367.96, giving the Mass a net milling cost of only 13½ cents per ton, for its own rock. Production, 1905, was 2,007,950 lbs. fine copper, of which 885,170 lbs. was heavy copper, secured at the rockhouses, and 1,122,780 lbs. was stamp copper, secured at the mill, giving a return of only 7.83 lbs. fine copper per ton, from rock stamped, rendering the return the lowest ever secured by any mine. Alone, the stamp rock would be hopelessly lean, but the production of heavy copper, taken out at the rockhouses, amounting to 6.17 lbs. per ton of rock treated, brings the total return to exactly 14 lbs. fine copper per ton—a low figure, but higher than that of some other Lake Superior mines. The management plans increasing production to 1,000 tons of rock daily, during the last third of 1906, and the increased tonnage will mean lower costs per ton. The management is doing its best to make a success of a very low grade, bunchy mine, and several years will be required to determine the result beyond question.

MASSEY STATION MINING CO. **ONTARIO.**

Office 43 Exchange Place, New York. Mine office: Massey Station, Algoma, Ont. John W. Thompson, president; Robt. McKay, secretary; Jos. Errington, general manager; R. C. Barclay, clerk and purchasing agent; James Summers, mining captain. Organized 1900, under laws of Ontario, with capitalization $1,000,000, shares $100 par. Is closely connected with the Orford Copper Co., which is controlled by the International Nickel Co., and is said to have expended circa $300,000 on development and equipment. Lands, 640 acres, also 160 acres miscellaneous lands, in Salter township, showing 5 ore bodies, of which two are being developed, these averaging circa 10′ width. One vein has been traced for 4,000′, and opened to a depth of circa 600′, by a shaft having 7 levels, opened 80′ apart, with considerable drifting on each level. This shaft develops a vein 9′ wide at surface, and 12′ at the bottom of the shaft, carrying ore of 3% to 5% copper tenor, with traces of gold and silver, and occasional ore of much higher grade. Vein dips at 85°, and the mine has upwards of 50,000 tons of ore blocked out for stoping.

The ore is a finely disseminated, silicious chalcopyrite, not adapted to wet concentration, owing to excessive sliming, hence a 50-ton experimental oil concentrator, using the Elmore process, has been installed, and is understood to be giving good results. Production is said to be about 100 tons of ore daily, and concentrates are shipped, for smelting, to the Copper Cliff smelter of the Canadian Copper Co., the silicious ore of the Massey being excellently adapted to fluxing the copper-nickel ores of the Sudbury district. Mining plant includes 6½x8″ and 10x12″ Lidgerwood hoists, and a 6-drill Ingersoll-Sergeant air-compressor. The property is being developed along sound lines, and is of much promise.

MASTODON GOLD & COPPER CO.

Letter returned unclaimed from former office, Spokane, Wash.

MATEHUALA MINING CO. **MEXICO.**

Mine office: Matehuala, San Luis Potosí, Mexico. Is said to have a smel-

ter, blown in March, 1906. Possibly is an erroneous title for Compañía Metalurgica.

MAUDEM MINE. **WYOMING.**

Owned by Topeka Copper Co.

GEWERKSCHAFT KUPFERBERGWERK MAXIMILIAN. **GERMANY.**

Mine office: Nieder-Ludgwigsdorf, Schlesien, Germany. Has 2 shafts, the Amalia of 75 metres, and the Aguust of 25 metres. Employed 40 men, at last accounts. Production averages circa 175,000 lbs. fine copper yearly.

MAY DAY MINING CO. **UTAH.**

Mine office: Eureka, Juab Co., Utah. J. A. Hunt, superintendent, at last accounts. Is a gold and silver mine, making a little copper as a by-product. Has a steam plant and concentrator.

MAYFLOWER MINING CO. **MICHIGAN.**

Office: 825-60 State St., Boston, Mass. Mine office: Calumet, Houghton Co., Mich. H. F. Fay, president; Geo. G. Endicott, secretary and treasurer; Jas. Chynoweth, superintendent; preceding officers, John C. Watson, Manning Emery and Stephen R. Dow, directors. Organized 1899, under laws of Michigan, with capitalization $2,500,000, shares $25 par, $8 paid in. Annual meeting, third Wednesday in March.

Lands, 840 acres, in Sections 7 and 8, T. 56 N., R. 32 W., also a millsite on Torch Lake. The Kearsarge mine lies to the north, Old Colony to the south and the South Kearsarge and Wolverine mines to the west. Exploratory work was begun in 1899 and ended March, 1906. No. 1, or Faull shaft, is 400′ deep, with considerable drifting on the first and second levels, and has a crosscut opening two parallel cupriferous amygdaloids, showing occasional patches of copper, but nothing of promise. No. 2, or Isle Royale shaft, 160′ deep, has several hundred feet of drifting and shows a bunchy amygdaloid, 10′ to 12′ wide, carrying more or less copper in a 2′ streak next to the hanging wall. No. 3, or Sandstone shaft, is 60′ deep, in a soft and badly broken amygdaloid, all of the strata near the Eastern Sandstone being much disturbed. No. 4 shaft, 580′ deep, starts from surface on an unnamed amygdaloid lying approximately 2,000′ east of the Kearsarge bed, and at a depth of 425′ runs into a parallel amygdaloid lying 90′ to the eastward of the first bed. The copper showing is poor. A fairly complete geological cross-section has been obtained by drill-borings. Surface improvements include a hoist good for 600′, boilers and air-compressor, with necessary buildings. On December 31, 1905, the company had $11,900 cash on hand, sufficient to pay taxes, and other running expenses of an idle property, for several years.

MAZAPIL COPPER CO., LTD. **MEXICO.**

Offices: 47, Peter St., Manchester, Eng. Works office: Apartado 17, Saltillo, Coahuila, Mexico. Mine offices: Mazapil, Zacatecas, Mexico, and Concepción del Oro, Zac., Mex. William Purcell, managing director; Walter J. Browning, superintendent; T. S. Abbott, engineer. Organized April 21, 1896, (as a reconstruction of company of the same name, organized February, 1891) with capitalization £300,000, shares £10 par; issued, £240,000.

Lands include the San Elijio, Salaberna and other mines, carrying aurifer-

ous and argentiferous copper and lead ores, in 2 groups, at Mazapil and Concepción del Oro. It is planned to drive a long tunnel from Concepción del Oro to the Aranzazu copper mine. Company controls the Ferrocarril Coahuila y Zacatecas, with 78 miles of main line, from Concepción del Oro to Saltillo. The company controls property having 83 different shafts and tunnels. District is arid, and operations are hampered frequently by shortage of water. Company plans building an aerial tram, to connect the mine with a railroad at San Pedro Ocampo.

There is a concentrator and smelter, of 500 tons daily capacity, at Concepción del Oro, but this is antiquated as to equipment. The new reduction plant, at Saltillo, to be finished in 1906, will be complete and thoroughly modern in equipment, being planned to do considerable custom business also, and is well located for such work. The smelter will have electric power, using alternating current generators, direct-connected to 2 Harrison-Fleming Corliss tandem compound condensing air-compressors. Production, 1903, was 6,108,123 lbs. fine copper, and, for 1905, was 6,496,000 lbs. fine copper. Property seems well managed, and bids fair to become one of the important copper producers of Mexico.

MAZE MINE. **JAPAN.**

Mine office: Nishi-Kambara-gori, Echigo, Japan. Opened A. D. 1688. Has several small veins, averaging 12″ in width, carrying chalcopyrite and iron pyrites, frequently associated with sphalerite and galena, lying mainly in propylite. Ore yields 17% to 20% copper, after careful selection. Production, which has decreased of late years, was 110,582 lbs. fine copper in 1900.

McALLISTER & CO. **NEW MEXICO.**

Mine and office: Silver City, Grant Co., N. M. Lucius P. Deming, general manager. Property is the Arizona mine, developed by a 1,200′ tunnel, producing auriferous and argentiferous copper ores. Has gasoline and steam power, a 20-stamp mill and a 40-ton concentrator.

McALLISTER MINE. **NEVADA.**

Mine office: Goodsprings, Lincoln Co., Nev. Lands, 16 full and several fractional claims, in the Greenwater district, Funeral Range, Nevada, showing veins of 2′ to 40′ width, with paystreaks of 12″ to 40″, carrying cuprite, melaconite and chalcocite, assaying up to 65 % copper, with spar and hematite gangue. District is extremely arid. It is expected that a railroad will reach within 12 miles, during 1906.

McALLISTER-ROWLAND COPPER MINING CO. **WASHINGTON.**

Office: Index, Snohomish Co., Wash. Property is the mine and mill of the Ethel Consolidated Mines Co., held under option.

McCABE EXTENSION MINING & MILLING CO. **ARIZONA.**

Office: Prescott, Ariz. Mine office: McCabe, Yavapai Co., Ariz. Reese M. Ling, president; E. R. McDowell, secretary. Organized July 14, 1900, under laws of Arizona, with capitalization $1,500,000, shares $1 par. Lands, sundry claims, adjoining the McCabe mine, opened by a 300′ shaft. Company suffered internal dissensions, during which the original promoters stepped from under. Idle and apparently moribund.

McCABE MINE. **ARIZONA.**

Bought, circa January, 1906, by Ideal Mining and Development Co.

McCOY GROUP. **ARIZONA.**

Office and mine: care of C. E. Taylor, owner, Globe, Gila Co., Ariz.

McKINLEY MINES, LTD. **BRITISH COLUMBIA.**

Office: Grand Forks, B. C. Lands, 4 claims, in Franklin camp, on the North Fork of Kettle river, about 40 miles above Grand Forks. Development, by trenching across an 80′ vein of ore, is said to give average assay values of $8 per ton, in copper, silver and gold.

McKINLEY MINING & SMELTING CO. **NEVADA.**

Lands are the Aurora group, 5 claims, at Ely, White Pine county, Nevada, formerly worked as a gold mine, but carrying copper ores in lower workings. Has a 300′ main shaft and about 1,000′ of drifts. Was formerly owned by Jas. A. Saxton, father-in-law of President McKinley, on strength of which the company adopted the name. Company was promoted by Hurd & Hearther, 510 Drexel Bldg., Philadelphia, senior partner of which firm is noted for promoting dubious mining propositions. Lands of company were sold at sheriff's sale, December 31, 1904, and bid in by sundry shareholders, who hope to reorganize. Property regarded as of promise, if in competent and honest hands.

McNEELEY & CROWLEY. **ARIZONA.**

Office and mine: Globe, Gila Co., Ariz. Lands, sundry claims, on Pinto Creek, opened by a 170′ tunnel, showing disseminated malachite and azurite.

McQUEEN MINE. **MONTANA.**

Owned by Pittsburg & Montana Copper Co.

MEADOW MINING CO. **MICHIGAN.**

Office: 50 State St., Boston, Mass. Mine office: Copper Falls, Keweenaw Co., Mich. W. F. Fitzgerald, president; John Brooks, secretary and treasurer; Wesley Clark, agent. Organized 1898, under laws of Michigan, with capitalization $1,500,000, shares $25 par. Lands, 364 acres, adjoining the Humboldt and Phœnix mines. Has been slightly prospected, but never was a producer. Fully described in Vol. I.

MEADOW MOUNTAIN MINING CO. **COLORADO.**

Offices: Aspen, Colo., and Bangor, Me. Mine office: Crystal, Gunnison Co., Colo. Employs 6 men. F. O. Beal, president; J. T. Stewart, vice-president and general manager; Victor Brett, secretary; J. T. Bowler, treasurer; W. Porter Nelson, assistant secretary and treasurer; preceding officers and C. W. Coffin, directors; John Peters, mine superintendent. Organized under laws of Colorado, with capitalization $100,000, shares $1 par. Lands, 8 claims, area 70 acres, also a 5-acre millsite, in the Rock Creek district, showing country rocks of limestone, porphyry and shale, carrying 5 fissure and contact veins, latter between limestone and shale, of which 2, under development, average 5′ width and carry chalcopyrite giving average assays of 3.5% copper, 4% lead, 23% zinc, 6 oz. silver and $1 gold per ton. Has shafts of 100′ and 300′, and an 800′ tunnel, with 2,750′ of underground openings, showing 1,000 tons of ore blocked out for stoping. Has gasoline power.

MECHAN HERMANOS. **MEXICO.**

Mine office: Viesca, Coahuila, Mex. Property is the Santa Maria copper mine, developed by shaft and tunnels.

MEDICINE BOW'S MINES CO. **WYOMING.**

Office: Laramie, Wyo. Mine office: Holmes, Albany Co., Wyo. Employs 4 men. G. S. Wright, president; Wm. Benton, vice-president and general manager; S. C. Downey, secretary; J. Welles, treasurer; G. S. Simmons, superintendent; H. H. Houston, engineer. Organized September 19, 1903, under laws of Wyoming, with capitalization $100,000, shares $10 par. Lands, 10 claims, area 205 acres, also a 10-acre millsite, showing syenite, granite and limestone, with dioritic traps, veins occurring as fissures in syenite and as contacts between limestone and trap. The Cuprite vein has been reported by company to average 12′ to 35′ in width. Development is by a 65′ shaft and a 960′ tunnel, with various pits and 1,500′ of underground workings, estimated to show 38,000 tons of ore, with 12,000 tons blocked out for stoping. Vein carries oxidized ores to a depth of 25′ to 50′ only, with bornite and chalcopyrite below. Shipments have returned 7% to 15% copper, 2 oz. to 12 oz. silver and $3 to $18 gold per ton.

MEDINA GOLD MINING CO. **CALIFORNIA & ONTARIO.**

Offices: 504 Bernice Bldg., Tacoma, Wash., and 520 University Blk., Syracuse, N. Y. Mine office: El Dorado, Hastings Co., Ont. Cole Saunders, president; Dr. T. H. Agnes, vice-president; Cole Saunders, Jr., secretary; Hon. Ira A. Town, treasurer; preceding officers L. D. Hill and Geo. Addison, directors. Was paying monthly dividends of ½ cent per share, with occasional extras of same amount, in 1905. Lands include the Kradle, Johnson and Gardner gold mines, opened by tunnels, at Oro Fino, California, and the El Dorado mine, in Ontario, which is said to show a wide vein of copper ore. Company is said to plan installing a smelter at the Ontario property.

MEGORRIS COPPER CO. **ARIZONA.**

Mine office: Silver Bell, Pima Co , Ariz. Mervin Rice, president; W. H. Coe, secretary. Capitalization, $600,000. Lands, sundry copper claims, in the Old Hat district, said to show good ore. Idle for some years.

MEGUNTICOOK GOLD & COPPER MINING CO. **COLORADO.**

Office and mine: Lake City, Hinsdale Co., Colo. P. G. Dawson, local director. Mine idle for several years, and company's finances much muddled.

GRUBE MEHLBACH. **GERMANY.**

Mine office: Weilmünster, Hessen-Nassau, Germany. Ores carry lead, copper, zinc, silver and gold. Has steam and electric power.

MELBA MINING CO. **ARIZONA.**

Mine office: Patagonia, Santa Cruz Co., Arizona. R. L. Hamill, superintendent. Property is the Alta mine, carrying ores of silver, lead and copper. Has steam power.

MELCZER MINING CO. **MEXICO.**

Office: 27 William St., New York. Was succeeded by the Copete Mining Co., but is said to have retained direct title to the property, under laws of Mexico, and was said to have been operating the Copete mines, early in 1905.

MELKEDALEN COPPER MINES, LTD. **NORWAY**

Reorganized, 1904, as Melkedalen, Ltd.

MELKEDALEN. LTD. **NORWAY.**

Offices: 23, Leadenhall St., London, E. C., Eng. Mine office: Evenaes, Ofoten Fjord, Norway. G. B. Mee, chairman; W. A. Stearns, secretary. Organized April 26, 1904, as a reconstruction of Melkedalen Copper Mines, Ltd., with capitalization £125,000, shares 10 s. par; issued, £58,543. Lands, 440 acres, in the Röros district, equipped with a 150-ton concentrator. Presumably idle.

MELROSE COPPER MINE. **AUSTRALIA.**

Office: Stock Exchange, Pitt St., Sydney, N. S. W., Australia. Mine office: Condoblin, Cunningham Co., N. S. W., Australia. H. E. A. Miller, chairman and secretary; G. Eason, treasurer; Malcolm Darrach, superintendent. Organized December 1, 1903, under laws of New South Wales, with capitalization £12,000, shares £500 par. Lands, 4 claims, area 120 acres, held under mineral lease from the crown, also 40 acres carrying water-rights, in the Condoblin district. Property was first known as the Boone West, and later as the Anaconda. Country rocks are metamorphic schist and porphyry, carrying 3 veins. No. 1 vein, opened by a 100′ shaft and 160′ tunnel, carries 3′ of chalcocite and 3′ of mixed ore. No. 2 vein, opened by a 300′ shaft and 85′ tunnel, shows a 6′ vein, with a paystreak carrying cuprite and chalcocite, balance of vein carrying circa 4% chalcopyrite and $4 gold and silver per long ton, with gangue of altered iron sulphides. No. 3 vein, opened by a 100′ shaft, shows 6′ of lead and copper ores. Mine has circa 1,400′ of openings, estimated to show 50,000 long tons of ore, with 6,000 tons of high-grade ore blocked out for stoping. Company plans building a smelter with one reverberatory furnace and an 80-ton water-jacket blast-furnace. Management is composed of experienced mining men, and property is considered promising.

MEMPHIS COPPER CO. **NEW MEXICO.**

Office: 601 Postal Bldg., Kansas City, Mo. Mine office: Organ, Donna Ana Co., N. M. Employs 10 men. J. I. McCullough, president and general manager; J. R. Bowersox, vice-president; Hill P. Wilson, secretary; F. M. Johnson, treasurer; preceding officers, C. B. Gill, G. F. Sanford, J. T. Wallace and A. M. Peck, directors; Jack Sune, superintendent. Organized June, 1905, under laws of New Mexico, with capitalization $1,000,000, shares $1 par; issued, $750,000, Has two shafts, of circa 175′ depth each, and shipped from same, during 1905, $7,965 worth of ore, giving average smelter returns of 17.5% copper and 7 oz. silver per ton.

MEMPHREMAGOG MINING CO. **QUEBEC.**

Mine office: Bolton Centre, Brome Co., Quebec. Property is the old Smith mine, idle for several years.

MENDOCINO COPPER KING MINING CO. **CALIFORNIA.**

Mine office: Yorkville, Mendocino Co., Cal. Idle.

MENDOTA MINE. **MICHIGAN.**

An extensive tract of mineral land, in the northeastern part of Keweenaw

county, Michigan, on which considerable work has been done, from time to time, but idle for many years past. Fully described in Vol. II.

MENDOTA MINE. **NEVADA.**

Mine office: Bullion, Elko Co., Nev. Ores carry silver, copper and lead.

MENDOZA y CA. **MEXICO.**

Mine office: Barranca del Cobre, Chihuahua, Mex. Produced 195 metric tons of copper, in 1902.

COMPAÑIA MINERA DE ORO y PLATA LA MENDOZA, S. A. **MEXICO.**

Was the Mexican incorporation of the Arizpe Gold & Copper Co., which died a fraudulent death, circa 1905.

MENLO PARK COPPER MINING CO., LTD. **NEW JERSEY.**

Mine office: Menlo Park, Middlesex Co , New Jersey. Idle.

SOCIEDAD ANOMINA COBRES DE MENORCA. **SPAIN.**

Offices: Gran Via, 32, Bilbao, Spain. Mine office: Mercadal, Mahon, Menorca, Spain. Cirilo de Gana, president; Fernando Olascoaga, vice-president; Manuel de Ozamir, secretary; Esteban Puego, managing director; Baron de Prisbuer, purchasing agent; Don Santiago de Arechago, consulting engineer. Organized October, 1901, under laws of Spain, with capitalization 2,000,000 pesetas, shares 250 pesetas par, 35% paid up. Lands, 411 hectareas, including the Rubia, Partida, Emilia and other copper mines, at the base of Mt. Toro, near Mercadal, district of Mahon, Island of Minorca, Spain. Property was undergoing development, with a force of about 60 men, at last accounts.

MERAKER MINES. **NORWAY.**

Owned by Vigsnes Kobbervaerks Aktiebolag.

MERCER SYNDICATE. **ARIZONA.**

Mine office: care of W. H. Mercer, P. O. Box 56, Globe, Gila Co., Ariz. Lands, sundry claims, in vicinity of the Five Points property, on which a shaft is being sunk.

MERISSKI WORKS. **RUSSIA.**

Office: care of R. A. Richner, Batum, Russia. Mines are near Tiflis, Kutais, Russia. Production, 1899, was 164,092 lbs. fine copper.

MERRIMAC COPPER CO. **COLORADO.**

Organized 1888, under laws of West Virginia. Claimed to have property at Taylor, Colorado, which is not a post-office. Charter forfeited.

W. & J. MERRY MINING CO. **CHILE.**

Mine office: La Serena, Coquimbo, Chile. Santiago Merry, general manager. Has steam power and a smelter.

MESA MINING & REDUCTION CO. **ARIZONA.**

Office and mine: Mesa, Maricopa Co., Ariz. Organized 1904, with capitalization $2,000,000. Idle.

MESCALERO MINING & MILLING CO. **NEW MEXICO.**

Mine office: Roswell, Chaves Co., N. M. J. A. Ryan, president; J. A. Cottingham, secretary; John S. Lenox, manager; James E. Hunt, superintendent; John Kinnie, mill superintendent. Mine, developed by a 400′ tunnel.

carries auriferous and argentiferous copper ores. Has steam and electric power, 20-stamp mill, concentrator, 100-ton cyanide plant and 50-ton smelter.

MESCAL MINING & MILLING CO. **ARIZONA.**

Letter returned unclaimed from former mine office, Providence, Arizona.

COMPAÑIA METALURGICA. **MEXICO.**

Mine office: Matehuala, San Luis Potosí, Mexico H. N. Nichols, president; E. Harms, superintendent. Plant includes concentrating and smelting works with two lead furnaces and 3 copper furnaces, having a daily capacity of 1,000 tons. Does a strictly custom business and employs circa 1,000 men.

METHOW GOLD & COPPER MINING CO. **WASHINGTON.**

Office: 77 Jamieson Blk., Spokane, Wash. Mine office: Winthrop, Okanogan Co., Wash. W. D. Scott, president; J. N. Tewinkel, secretary and treasurer. Organized under laws of Washington, with capitalization $90,000, shares 5 cents par. Lands, 8 claims, area 150 acres, showing fissure veins in metamorphosed conglomerates of Huronian age, carrying sulphide ores assaying 9% copper, 2 oz. silver and $5.50 gold per ton, developed by a 52′ shaft and three tunnels, longest 465′. Has available water power and timber. Presumably idle.

METROPOLITAN MINING CO. **WASHINGTON.**

Mine office: Berlin, King Co., Wash. Ores carry gold, silver and copper. Has water power. Presumably idle.

COMPAÑIA METALURGICA MEXICANA. **MEXICO.**

Office: 82 Beaver St., New York. Mine offices: Sierra Mojada, Coahuila, Mex., and Concepción del Oro, Zacatecas, Mex. Employs circa 1,500 men. Works office: San Luis Potosí, S. L. P., Mex. Robt. S. Towne, president and treasurer; Geo. Foster Peabody, first vice-president; A. Foster Higgins, second vice-president; Chas. J Nourse, Jr., secretary and assistant treasurer; D. C. Brown, general manager; Geo. H. Carnahan, superintendent; C. M. Van Cleve, smelter superintendent; Frank W. Carnahan, engineer; James Ganett, mine superintendent at Sierra Mojada; Ludwig Heldt, mine superintendent at Concepción del Oro.

Organized 1890, under laws of New Jersey, with capitalization $4,000,000, shares $100 par, in $1,000,000 cumulative 8% preferred, $1,250,000 guaranteed 6% second preferred, and $1,750,000 common stock. Bonds, $2,000,000, at 5%; sinking fund, 2% per annum of outstanding bond issue. Annual meeting, first Monday in June. Morton Trust Co., New York, registrar. Is said to have discontinued dividends, temporarily, during 1905, owing to heavy outlay for mines, smelters, railroad and other enterprises.

Property interests are extensive, including control of numerous subsidiary mining, transportation and land companies, among the more important being the Sombrerete Mining Co. and the Mexican Lead Co., at Sombrerete, Zacatecas, Mexico, and the Montezuma Lead Company, Alvarez Lead & Timber Co., Mexican Mineral Railway Co. and Potosí & Rio Verde Railway Co. Among the properties owned outright are the Veta Rica mine, at Sierra Mojada, producing argentiferous lead and copper ores, averaging 3% copper, 5% zinc and 20 oz. silver per ton. This property is opened by a 600′ main shaft, and is a

very important lead producer. The Cerro Prieto and adjoining mines, at Concepción del Oro, are opened by tunnels, producing auriferous copper ores, employing circa 100 men. The San Pedro and San Pablo mines also are important producers, and the company owns extensive tracts of timber lands.

The smelter, at San Luis Potosí, is of circa 700 tons daily capacity, and has a modern equipment throughout, including roasting furnaces, lead and copper stacks, and a briquetting plant. The works have steam and electric power and employ circa 1,000 men. This is an important mining company, and a very considerable producer of lead and silver, copper being made mainly as a by-product.

MEXICAN-ARIZONA MINING CO. **ARIZONA.**

Absorbed, 1903, by New England & Clifton Copper Mines of Arizona.

MEXICAN COPPER CO. **ARIZONA.**

Letter returned unclaimed from former mine office, Martinez, Arizona.

MEXICAN COPPER CO. **MEXICO.**

Mine office: Salinas, San Luis Potosi, Mex. R. B. Watson, manager, at last accounts. Has steam and gasoline power and a small smelter. Presumably idle.

MEXICAN COPPER SYNDICATE, LTD.

Offices: St. George's House, Eastcheap, London, E. C., Eng. J. Peters, chairman; G. Mountier, secretary. Capitalization, £15,000; issued, £1,700. Location of property, if any, not learned. Apparently moribund.

MEXICAN INVESTMENT & DEVELOPMENT CO. **MEXICO.**

Office: Guanajuato, Gjto., Mexico. Lands include the Auga Blanca mine, area 40 pertenencias, located 30 miles northwest of Autlán. This property, opened circa 1860, by John and Edward Blake, was the leading copper producer of Mexico, for two decades. The mine has a 700′ tunnel, developing a vein of 12′ to 80′ width, carrying chalcopyrite, of 4% to 5% tenor, devoid of both gold and silver. The reduction plant includes crushers, rolls, jigs and Wilfley tables, and miscellaneous improvements, including a sawmill, smelter, iron foundry, and iron rolling-mill, which were completed, under great disadvantages, and operated successfully, by the Blakes. The mine is opened to shallow depth only, but, given a modern equipment, should make a good property.

MEXICAN MINERALS CO., LTD. **MEXICO.**

Offices: 28, Budge Row, London, E. C., Eng. Letter returned unclaimed from former mine office, Zimapán, Hidalgo, Mexico. S. Crowder, managing director; Hedley D. Crowder, mine manager, at last accounts. Capitalization, £36,000; issued, £31,507; debentures, £10,000. Lands, 300 pertenencias, area circa 750 acres, including the Montezuma mine, carrying ores of copper, gold and silver. Mine is developed open-cast and has water and electric power. Idle and company moribund.

MEXICAN MINING SYNDICATE. **MEXICO.**

Letters returned unclaimed from alleged office, New York, and alleged mine office, Acuitzio, Michoacán, Mexico. Organized July 22, 1905, under laws of Maine, with capitalization $1,000,000, shares 10c. par, to succeed I.

Natividad Mining Co., which was barred from the mails, as a fraud, by the United States postal authorities.

MEXICAN UNION MINING CO. **MEXICO.**

Office: 753 Monadnock Bldg., Chicago, Ills. Mine office: Unión de Tula. Jalisco, Mexico. Newton B. Storer, president; Chas. G. Thompson, secretary; Wm. H. Lees, general manager; B. W. Sweet, mill superintendent and engineer. Organized April, 1902, under laws of Arizona, with capitalization $1,000,000. shares $1 par. Lands, 100 pertenencias, area 247 acres, in the Ayutla district showing a 30′ fissure vein, with laterals, in limestone, opened by a 275′ shaft, showing chalcopyrite giving assays of 7% copper, 10 oz. to 50 oz. silver and from a trace to $10 gold per ton. Has a 75-h. p. steam plant and has contracted for the development of a water power. The 35-ton concentrator has a 7x9″ Dodge crusher, 1 train of rolls, one 5′ Huntington mill and 3 Overstrom tables.

MINA MEXICO. **MEXICO.**

Mine office: Sabinal, Chihuahua, Mexico. Uriatta Hermanos, owners. Ores carry silver, copper and lead. Has steam power.

MEXICO CONSOLIDATED MINING & SMELTING CO. **MEXICO.**

Office: 60 State St., Boston, Mass. Mine office: Guanacevi, Durango Mexico. J. A. Coram, president; John T. Judd, vice-president; Larkin T. Trull, second vice-president; W. J. Freeman, secretary; Stephen M. Crosby, treasurer; preceding officers, W. S. McCornick, L. R. Rogers, Geo. Himmighoffen, Geo. C. Beckman, S. L. Rosenstamm, Spencer W. Richardson and E. L. White, directors; F. C. Morehouse, general manager. Organized July, 1904, under laws of Maine, with capitalization $2,500.000, shares $10 par; issued, $2,400,000. First National Bank of Boston, registrar; Federal Trust Co., Boston, transfer agent. Annual meeting, third Wednesday in June. Officers of company are closely identified with the Bingham Consolidated Mining & Smelting Co. In addition to the property in Durango, company is said to have lands in the San Pedro district of Chihuahua, Mexico, showing considerable ore bodies carrying good average values in copper, silver and gold, predominant values being in silver.

MEXICOLA GOLD-COPPER MINING CO. **COLORADO.**

Letter returned unclaimed from former office, Cripple Creek, Colo. M. J. Maynard, president; T. J. Hines, secretary. Organized under laws of South Dakota, with capitalization $200,000. Lands, 3 gold claims, north of Rhyolite Mountain, and 9 copper claims, area 78 acres, in the Little Badger district, near Howard, Fremont county, Colorado.

MIAMI COPPER CO. **ARIZONA.**

Letter returned unclaimed from alleged mine office, Globe, Gila Co., Ariz. Organized 1905, with capitalization $500,000, shares $1 par.

MICHIGAN & ARIZONA DEVELOPMENT CO. **ARIZONA.**

Office: care of Little & Prindle, Guaranty Loan Bldg., Minneapolis, Minn. This company reopened the Helvetia mine, and reorganized the Helvetia Copper Co., under a plan of promotion explained in Volume V. Is inactive, property consisting solely of a considerable share interest in the Helvetia Copper Co.

MICHIGAN-ARIZONA MINING CO. **ARIZONA.**

Office: 17 First St., Muskegon, Mich. Mine office: Mammoth, Pinal Co., Ariz. Employs 4 men. S. H. Hamilton, president and general manager; James Hamilton, vice-president; Theo. P. Swift, secretary, treasurer and engineer. Organized August 22, 1904, under laws of Arizona, with capitalization $5,000,000, shares $1 par. Lands, 7 claims, area 140 acres, in the Bunker Hill district, showing a country rock of granite, ore occurring in fissure veins and also as impregnations in the country rock, and, at times, in brecciated masses of country rock, with porphyritic intrusions. Has a 50′ shaft and tunnels of 93′ and 150′, showing cuprite, melaconite, malachite, chalcocite and a little chrysocolla, giving average assays of 29.2% copper, 5 oz. silver and $1.20 gold per ton. Is 22 miles from the Santa Fé, Prescott & Phoenix railroad, which is expected to reach within 8 miles, and a spur can be built to the mine if necessary. Company plans continuing development, and may build a small concentrator.

MICHIGAN BOY MINING & MILLING CO. **WYOMING.**

Office: care of Dr. C. W. Long, superintendent, Denver, Colo. Lands, supposedly are in the Encampment district of Wyoming. Idle.

MICHIGAN-COLORADO MINING & MILLING CO. **COLORADO.**

Office: Colon, Mich. Mine office: Florissant, El Paso Co., Colo. W. H. Wagner, president; J. W. Bryant, vice-president; Dr. A. J. Kiser, secretary; A. C. Himebaugh, treasurer; John M. Kellogg, general manager. Organized December 10, 1902, under laws of Michigan, with capitalization $500,000, shares, $25 par. Annual meeting, first Tuesday in December. Lands, 14 claims area 280 acres, also a 5-acre millsite and sundry water rights. Succeeded to properties of Colorado Springs Copper Mining & Tunnel Co., and Blue Mountain Copper Mining Co., circa January, 1906. Has some development, by tunnel, and plans continuing same and adding steam power and a 4-drill Sullivan air-compressor.

MICHIGAN COPPER & GOLD MINING CO. **UTAH.**

Office: 404 West Third South St., Salt Lake City, Utah. Mine office: Frisco, Beaver Co., Utah. Michael H. Osborne, president; L. C. Johnson, secretary. Organized December, 1902, under laws of Utah, with capitalization $300,000, shares $1 par. Lands, 4 claims, area 80 acres, known as the New York group, in the San Francisco district, near the Horn Silver mine, opened by a 40′ shaft. Idle, but able to levy assessments.

MICHIGAN COPPER MINING CO. **MICHIGAN.**

Office: 15 William St., New York. Mine office: Rockland, Ontonagon Co., Mich. Employs 280 men. Jos. E. Gay, president; J. Wheeler Hardley, secretary; John R. Stanton, treasurer; preceding officers, Jos. W. Howe and Alfred M. Low, directors; Samuel Brady, superintendent; S. Howard Brady, assistant superintendent; Chas. R. Forbes, engineer; Henry Stubensky, clerk; S. S. Jennison, master mechanic. Organized Jan. 5, 1899, under laws of Michigan, with capitalization $2,500,000, shares, $25 par; $17 paid in. Last assessment, $1 per share, was levied December, 1903. Annual meeting,

first Tuesday in May. American Loan & Trust Co., Boston, transfer agent; Old Colony Trust Co., Boston, registrar.

Official returns to the state of Michigan, as of date Jan. 1, 1905, disclose the following figures:

Amount of cash paid in on capital stock	$1,600,000.00
Amount paid in by conveyance of property	670,350.00
Entire amount invested in real estate	734,550.46
Amount of personal estate	141,154.84
Amount of floating debt	33,134.45

Lands, 4,870 acres of mineral territory, 1,466 acres of timber and miscellaneous lands, and a 150-acre millsite, giving total holdings of 6,686 acres, mineral lands being in Sections 1, 2, 3, 9, 10, 11, 13, 14, 15, 16, 17, 21, 22, 23, 24, 25, 26, and 27, Town 50 North, Range 30 West. The main tract is 3 miles east and west by 4½ miles north and south, in addition to which there are four scattering tracts to the westward, one of 40, two of 80 and one of 160 acres, all carrying the outcrop of the Calico amygdaloid. The Michigan lands include the old Minnesota, Rockland and Superior mines. The Superior made 283 tons, 1,331 lbs. fine copper, 1856-1869 and 1876-79. The Rockland, lying next east of the Minnesota, was operated 1853-1870 and made 3,105 tons, 309 lbs. fine copper, from the Minnesota contact vein, which averaged about 2′ width and carried considerable silver, in that mine. The old Minnesota mine, opened 1847, closed 1870, made 17,352 tons, 668 lbs. fine copper, and paid dividends of $1,820,000.

The Minnesota, or Minesota, as it was then spelled, was discovered by a line of prehistoric pits, in one of which was a 6-ton mass of copper, raised on skids, on top of which grew a hemlock tree having nearly 400 rings of annual growth. Immense masses of virgin copper were taken from the Minnesota, the largest, found 1856, measuring 12′6″x18′6″x46′, weighing 527 short tons, and requiring the work of 20 men for 15 months in cutting it into pieces small enough for hoisting. The Minnesota was opened on a contact vein, having a gangue of quartz, epidote and calcite, with an amygdaloid hanging and conglomerate footwall, both of which were impregnated with copper near the contact. Miners called the Minnesota a conglomerate mine, because more copper was found in the footwall than in the denser amydaloid hanging-wall. The richest ground occurred near the "counter vein," a transverse fissure. The Minnesota had a 40-ton mill, with gravity stamps, but the production was mainly from masses, and the smaller pieces of native metal called barrel-work. In 1870 the old Minnesota company met low prices for copper, a pinching of the vein, and the necessity for more powerful hoists, simultaneously, and gave up the struggle. The openings above the adit level, being free from water, were worked by tributors, for years afterwards, and yielded hundreds of tons of mass and barrel copper, affording evidence that a large amount of heavy copper must remain in the lower stopes, then inaccessible to tributors, because filled with water, and these also should yield considerable stamp rock, left unmined in the days when nothing under 3% rock paid for milling.

The Minnesota had 10 shafts, deepest circa 1,100′. Four central shafts

were sunk from surface on the North Minnesota fissure, which joined the contact vein at about 300′ depth. The Michigan mine is a combination of two entirely new mines and a reopened old mine, its shafts being sunk on the Calico amygdaloid, a bed outcropping 140′ north of the Minnesota contact vein, and a few feet north of the North Minnesota fissure. In addition to the Calico lode, Minnesota contact, North contact and Branch vein, all more or less developed by the present workings, the Michigan tract carries the Knowlton, Mass, Ogima and South Amygdaloid beds, also an unnamed amygdaloid farther south, these latter belonging to the Evergreen belt, worked a few miles to the northeastward by the Mass and Adventure mines. The Knowlton, or northernmost of the Evergreen series of parallel lodes, lies circa 1,000′ south of the old Minnesota shafts, and a 7′ amygdaloid, supposed to be the Butler, opened to some extent in Peninsula Bluff, 2,000′ south of "B" shaft, shows heavy copper and stamp rock. There are three old shafts on the Butler lode, also an adit cutting several parallel cupriferous beds. There also are copper-bearing amygdaloid outcrops north of the Calico bed, on which no work has been done.

The Calico parallels the contact vein, and the old Minnesota mine has been reopened by crosscuts, simultaneously with the development of a new mine on the Calico itself, which has been opened for nearly a half mile, and the making of a second new parallel mine on the Branch vein. The country rock is a melaphyr trap, and the Calico amygdaloid ranges from almost a trap to nearly a conglomerate, carrying considerable felsite, with occasional patches of sandstone, and large quantities of epidote, prehnite and calcite. The strike is approximately N. 68° E., with a dip of about 46° 30′ and a width of 5′ to 25′, with about 9′ average width. Most of the copper occurs in a 2′ to 3′ paystreak near the footwall, though occasional good patches occur in the center, and on the hanging-wall. The copper carries a little silver and is mostly in nodules, called shot-copper, with a little barrel-work and occasional small masses, the heavy copper occuring mainly near the intersections of numerous cross-fissures filled with clay gouge. The lode is strong, standing well without timber, and is sinuous both as to strike and dip, with very irregular walls, the amygdaloid bed merging into the trap footwall by almost imperceptible degrees. There also is a tendency to split, the "footwall vein" being rich in such cases, but leaving the main bed very lean in copper. There also is a "hanging-wall vein," and branch veins, in addition to which the Minnesota contact and North Minnesota fissure are found within 140′ distance of the Calico. In fact, the entire section between the Calico and the Minnesota contacts, and for a little distance on either side, comes very near being a sort of magnified stockwerk, where copper may occur at almost any point, even where least expected. None of the old shafts are in commission, and the new mine is opened by 3 shafts, all sunk on the Calico bed.

"A", the westernmost shaft, lies about 1,000′, on the strike of the lode, from the boundary line of the National mine. This is 7x18′ inside of timbers, has 3 compartments, and is 1,781′ in depth, not having been deepened during 1905 The lode runs as wide af 18′ in places and shows some excellent ground. Stoping is in progress on numerous levels. A crosscut was sent on the 14th level to

the contact vein of the old Minnesota, which averages 4′ width at that point, and carries rich copper for a distance of circa 150′, then grows leaner.

"B" shaft, with 2 compartments, lies 985′ east of "A" and also is 1,781′ in depth. The lode runs 20′ to 25′ wide in places and the lower levels show some good stopes on the Calico. This shaft has a Burnham sinking pump, with capacity to fork 400 gallons per minute from a quarter-mile depth. The "Branch Vein" is opened from this shaft, this ore body lying between the Calico and the Minnesota contact, closely underlying the former on the fifth level but receding therefrom steadily, until it touches the contact vein, just above the thirteenth level, but rolls away therefrom at greater depth. The "Branch Vein" is narrow, but very rich, showing many masses of tons in weight, a 20-ton mass having been found in 1905, this being the largest mass of copper secured in any Lake Superior mine for some years. The "Branch Vein" has been opened from the fifth to fourteenth levels by crosscuts. The eastern drifts of the "Branch Vein" are making the best showing. The old Minnesota mine was unwatered from "B" shaft by diamond drill holes, bored across at each successive level. The old workings were found in very bad shape, after three decades of neglect, and the contact vein is reached by crosscuts on the eleventh and thirteenth levels, below the bottom of the old workings, showing a vein of about 20′ width, with 6′ to 7′ on the hanging wall carrying copper in good quantities.

"C" shaft lies 1,353′ northeast of "B" and was 350′ deep at the end of 1905. The formation is more settled than to the westward, and the showing on the Calico bed is better than was secured at similar depth by the two other shafts, but "C" shaft was idle, for several years, until April, 1906. Adjoining "C" shaft is an old shaft sunk on the Minnesota contact vein, with a depth of circa 675′, and having its collar 90′ below the collar of "C" shaft. The old workings are being unwatered by diamond drill holes, bored on successive levels, on the same plan as was followed in unwatering the old mine workings from "B" shaft. The "Branch Vein" of the Michigan is thought to be identical with the "North Vein" formerly worked in the Rockland mine, now a part of the Michigan mine and tributary to "C" shaft.'

There is room on the main tract of the Michigan for an additional shaft west of "A", and, if developments warrant, the extent of the company's mineral lands is such that a considerable number of new shafts could be opened eventually on the various cupriferous beds carried on the Michigan lands. The mine has circa 7 miles of new openings, and operates about 30 power drills.

The "Branch Vein" is furnishing about half the copper now made by the mine, although it is supplying but one-third of the rock tonnage, that is, the Branch is about twice as rich as the Calico, the former yielding about 32 lbs. refined copper per ton as compared with 16 lbs. from the latter. Daily rock production is about 480 tons, of which approximately 160 tons is from the Branch and 320 tons from the Calico. Production is about one-third heavy copper and two-thirds stamp copper. The width of the Branch is 2′ to 8′, with an average of 4′, but as the vein dips at approximately 58°, ample head-room is allowed for working, without beating away worthless rock. The Branch carries mainly

mass and barrel copper, with considerable stamp rock. The showing throughout the openings in the Branch is almost uniformly good, and it affords stoping ground from end to end of every opening. The showing of heavy copper is the best now made by any Lake Superior mine, and the average of 480 lbs. per fathom, or 32 lbs. fine copper per ton, puts the Branch ahead of the Champion and Wolverine mines, and second only to the Calumet & Hecla among Lake Superior copper producers. The "Branch Vein" has been opened for a quarter mile laterally, and has been traced for two miles. Openings on the Branch are being secured about twice as fast as ground is stoped, which means that ground is being opened at the rate of about 325 tons daily, which rate can be increased, a little later. The mass copper found throughout the "Branch Vein," is in pieces weighing from a few hundred pounds up to 20 tons each, and two men, using pneumatic chisels, are employed steadily, in cutting these masses into pieces suitable for hoisting.

The engine-house, 50x115′, stands midway between shafts "A" and "B". The "A" section has a 24x60″ Webster, Camp & Lane double-cone straight-face hoist, with a 7′ drum having a 15′ face, carrying 4,000′ of cable and capable of raising 4-ton skips in counterbalance at 3,500′ per minute from a depth of 3,500′. The hoisting cable passes around solidly anchored sheaves, giving a straight pull at each shaft. The "B" hoist, installed 1905-1906, is a 24x60″ Allis-Chalmers duplex-cylinder straight-face hoist, operating 2 drums in balance, or separately, also good for 3,500′ depth. The temporary hoist, formerly used for "B" shaft, is to be used at "C", this being a 13x10″ hoist with 6′ drums. The boiler-house, between the two sections of the engine-house, has four 165-h. p. Burt locomotive firebox boilers, with room for a fifth, also a 1,000-h. p. Cochrane feed-water-heater and purifier. The power-plant includes a 40-drill Ingersoll-Sergeant two-stage air-compressor. A 12-drill Norwalk air-compressor and a 10-drill Ingersoll-Sergeant air-compressor, displaced by the new compressor, have been installed in the basement of the engine-house, as auxiliaries.

The shaft-rockhouses at "A" and "B" are duplicates, each having 800-ton storage-bins and each being equipped with a 50-h. p. Nordberg engine, two 18x24″ crushers, one 13x20″ crusher, and a steam-hammer for mass and barrel work.

The machine shop is 30x60′, and other mine buildings include a stone smithy, carpenter shop, warehouse, office building, and a 22x50′ model changing house. Water is secured from the old Minnesota dam, the mine and location having mains and hydrants, with a Knowles pump in the basement of the power-house capable of raising a 5″ stream against a 400′ head, and an auxiliary Deane pump, 200′ distant, capable of raising a 5″ stream against a head of 425′ There are acetylene gas plants in the power-house and in each rockhouse, and a 250′ coal-trestle, with inclined tunnel and tramway underneath, leading to the boiler-house. All buildings are connected by a private telephone system, and the mine is served by the Mineral Range railroad.

Stamping was begun November 12, 1903, with a leased head, at the Mass mill. Notice has been given that this must be surrendered September 1, 1906, when it will be required by the owner. It will be necessary for the Michigan to

secure custom milling for nearly another year and arrangements have been made to have rock stamped at the Atlantic mill. Work was started, April, 1906, on the new mill of the Michigan, adjoining the Mass mill, at Keweenaw Bay, Lake Superior. This will have two heads, but the exact type has not been fully determined as yet, and probably will go into commission during the latter half of 1907. The Michigan owns some dressing machinery, including a 5-stamp gravity battery and 10 Overstrom tables, in the Mass mill, which will be removed to the new mill.

Production, 1905, was 2,891,796 lbs. fine copper, a small gain over the previous year. Income, exclusively from production, was $453,683.37, and ordinary expenditures were $407,767.21, leaving a mining profit of $45,916.16, against which were construction expenses and land purchases aggregating $50,686.92, leaving a net decrease of $4,770.76 in assets by the year's operations. The company ended 1906 with a balance of assets of $103,249.63, and doubtless will levy an assessment, probably of $1 or $2 per share, for the cost of the new mill, which probably will be about $150,000. Production, January, 1906, was 196 tons of mineral, this being the largest in the history of the mine, and greater than ever was secured in one month by the old Minnesota mine, which, in its day, was the greatest copper mine in the Lake Superior district, and one of the greatest dividend-paying mines of the United States. In the early months of 1906 the mine was making net mining profits estimated at about $10,000 per month, and, with the aid of the new hoist at "B" shaft, and with a small tonnage from "C", should be able to produce circa 1,000 tons of stamp-rock daily by the time the new mill goes into commission. With the practical doubling of production, which is assured, the Michigan will take an important place among the copper producers of the Lake Superior district, and should earn profits that will enable the mine to join the ranks of the dividend-payers, circa 1909. The management, both general and local, is all that could be desired, and is as good as is enjoyed by any copper mine—which is high praise, but fully deserved.

MICHIGAN-MEXICAN MINING CO. **MEXICO.**

Dead.

MICHIGAN MINING CO. **WYOMING.**

Office: care of D. W. Gill, Cheyenne, Wyo. Moribund.

MICHIGAN & MONTANA COPPER MINING & SMELTING CO. **MONTANA.**

Office: Kalispell, Mont. Mine office: Altyn, Teton Co., Mont. J. M. Harris, manager. Lands, sundry claims, some distance from rail transportation, giving fair assay values from auriferous and argentiferous copper ores. Is said to have a 100-ton concentrator. Presumably idle.

MICHIGAN-NEW MEXICO COPPER CO. **NEW MEXICO.**

Office: Grand Rapids, Mich. Mine office: Lordsburg, Grant Co., N. M. J. L. Hamilton, president; C. R. Luton, secretary and general manager; Wm. H. Stevens, superintendent. Lands, 4 claims, area 80 acres, known as the Dakota-Pearl mine, in the Burro Mountains, circa 15 miles from the Santa Rita mines. Ores give assays up to about 8.5% copper, $3 silver and $4 gold

per ton. Has a 280′ shaft, and at last accounts planned installing a 50-ton leaching and cyanide plant, and a smelter. Presumably idle.

MICHIGAN SMELTING CO. **MICHIGAN.**

Office: 27 State St., Boston, Mass. Works office: Houghton, Houghton Co., Mich. Wm. A. Paine, president; Frederic Stanwood, secretary and treasurer; Frederick I. Cairns, general manager; preceding officers, John R. Stanton and Chas. H. Paine, directors; Frank Klepetko, consulting engineer. Organized 1903, under laws of Michigan with capitalization $500,000, shares $25 par.

Property is a reduction plant, located circa 3 miles west of Houghton, near the old Atlantic stamp-mill, with frontage on Portage Lake. It was designed by Frank Klepetko and is the largest and most modern smelter in the Lake Superior district, with capacity of 90,000,000 lbs. fine copper yearly, built to smelt the mineral of the Stanton and Copper Range groups, including the Mohawk, Wolverine, Atlantic, Baltic, Trimountain, Champion, Winona and Michigan mines.

The plant is terraced throughout, permitting economical and largely automatic handling of material. The terraces for the different structures are sand-graded, with stone retaining walls. Mineral is delivered to the works in 40-ton bottom-dumping steel cars, by the Copper Range railroad, which also hauls away the refined copper, for shipment from the Copper Range wharves, in Houghton. The 3,000-ton mineral storage bins, holding ten days' supply for the works, are located on the upper terrace. Mineral is dehydrated in rotary dryers, by waste gases from the furnaces, taken to the furnaces in tram-cars and dumped into hoppers on the charging floor. Coal-trestles, on an upper plateau, hold 15,000 tons of hard and soft coal, with separate storage compartments for charcoal, sand and limestone. Tunnels under the coal-trestle lead to the boiler-rooms and furnaces, fuel being delivered in tram-cars, loaded cars descending by gravity.

The reverberatory furnace building, of steel and brick, with truss roof, is 160x205′ in size, and has 5 furnaces, with room for a sixth. Two furnaces are 16x36′ each, two are 14x23′ each and one is 15x18′, while a sixth, to be built as a spare, is to be 16x40′, and of 100 tons daily capacity. The two larger furnaces were built 18x50′, over all, but gave so much trouble that they were cut down 14′ in length.

Alternating with the larger reverberatories are one 300-h. p. and two 200-h. p. Stirling water-tube boilers, heated by waste gases from the furnaces. After leaving the boilers the waste gases are drawn through a 6x8′ subterranean flue, with arched roof, up the hill to a 150′ smokestack with base 100′ above the furnace building. The reverberatory building has two 5-ton electric traveling cranes.

From the reverberatories the molten copper goes to two blast furnaces, on a lower level, north of the reverberatories, where blister copper is cast mechanically, in moulds, upon a circular table, cooled in water and carried by a link elevator to the loading platform. The cupola building is 40x70′, of steel and brick, with two floors. Slags are carried mechanically to the

sampling mill, and reduced in a 30-ton crusher of 1,000 tons daily capacity, for resmelting. The waste slags from the final fusion are granulated by jets of water, and discharged through launders, to low ground northward, for grading.

The combination machine-shop and power-house, of steel and brick, has a complete equipment of shop tools, driven by an independent engine, and a 300-h. p. Nordberg horizontal tandem-compound engine driving a 200-kw. generator actuating the rotary blowers for the blast furnaces. Electric power is used extensively, for operating the drying plant, casting machinery and electric cranes, and also for lighting purposes, and actuates three specially designed Jeffrey electric locomotives, of 100-ton draw-bar pull, taking current from overhead trolleys and hauling 8 pressed steel Sheffield mineral and coal cars, tracks reaching practically every part of the plant.

Miscellaneous buildings include a combination two-story and basement office and laboratory, of brick, heated by exhaust steam, also a 40x60′ iron-sheathed frame warehouse, barn, etc. The plant has two 50′ track-scales, of 150 tons capacity each, one for mineral and one for coal and flux, with smaller scales at other points. Water is obtained from the old Atlantic dam, on Cole's creek, through a 4,300′ flume, with capacity of 5,000 gallons per minute, leading to a 50,000-gallon water-storage tank, located 100′ above the works, giving good pressure at all points.

The works are treating the mineral of six mines, each of which is smelted separately, and are turning out circa 5,500,000, lbs. of refined copper monthly. The sixth reverberatory will give a monthly capacity of 10,000,000 lbs. fine copper, providing for growth of the mines for some years to come. In August, 1905, these works broke a world's record for casting from a single furnace, by turning out a charge containing 292,000 lbs. fine copper in 7 hours, or at the rate of 750 lbs. per minute. This work was done by a crew of ten men, of whom 5 attended the furnace, and one operated the casting machine, while 4 men were required to inspect, sort and load the ingots in cars.

In its earlier stages the Michigan smelter was severely criticised, much of the criticism being unfair, and nearly all of it uncalled for. The minor defects inseparable from a large plant embodying the most advanced methods and machinery, have been eliminated, and the plant is working smoothly and economically, accomplishing the results for which it was planned, and is a credit to its designer and management.

MICHIZONA DEVELOPMENT CO. **ARIZONA.**

Option surrendered and company wound up, 1905.

MICHOACÁN RAILWAY & MINING CO., LTD. **MEXICO.**

Offices: 2, Suffolk Lane, Cannon St., London, E. C., Eng. Mine office: Angangueo, Michoacán, Mexico. T. Adams, secretary; Jas. W. Malcolmson, consulting engineer. Organized Jan. 29, 1889, with capitalization £105,364, shares £1 par, in £21,015 "A" cumulative 7% preference shares, £12,190 "B" non-cumulative 7% preference shares, £70,745 ordinary shares and £1,414 founders' shares; issued, £99,370. Debentures, £27,090, in a 4% prior lien, and £103,000 in 4% mortgage bonds. Railway rights orginally

held have been disposed of, remaining property being sundry mines and mineral lands, now leased to the Compañía Metalurgica de Angangueo.

MICHOACÁN SAN FRANCISCO COPPER MINES SYNDICATE, LTD. **MEXICO.**

Voluntarily liquidated, March, 1902.

JOSÉ MICULICICH. **PERÚ.**

Office and mine: San Tadeo, Yauli, Junin, Peru. Was a small producer of argentiferous copper ore, at last accounts.

MIDDLEMARCH COPPER CO. **ARIZONA.**

Office: 212 Henne Bldg., Los Angeles, Cal. Mine office: Middlemarch, Cochise Co., Ariz. H. Bert Ellis, president: M. M. O'Gorman, vice-president and general manager; preceding officers, Rufus L. Horton, Richard Gird and Wm. King Gird, directors; Broadway Bank & Trust Co., Los Angeles, treasurer; M. E. Anderson, mine superintendent. Organized April 26, 1897, under laws of California, with capitalization $1,000,000, increased, March 28, 1906, to $3,000,000, shares $100 par. Of the new stock, $1,000,000 is to be given the Cobreloma Copper Co. for its property, and $1,000,000 placed in the treasury for development purposes, including the building of a smelter. An authorized bond issue of $200,000 has been annulled. Annual meeting, first Monday in April.

Lands, 68 claims, area 1,400 acres, in the Middlemarch division of the Dragoon district, Dragoon Mountains, showing 6 parallel contact veins, between limestone and granite-porphyry, having a general strike of NW. and SE., with, an average dip of 42° to 54° to the southwest. Two of these ore bodies, under development, range 30′ to 80′ in extreme width, showing the usual oxidized ores above, with sulphides below, chalcopyrite being the predominant ore of the base zone. Ores carry an average of 4% to 5% copper, from nothing to 10% zinc, 2 oz. silver and 60 cents gold per ton. Development is by shafts of 210′, 160′, 100′, 165′, 110′ and 305′, also by tunnels of 285′, 193′, 425′ and 625′, with about two miles of underground workings, estimated by company to show 200,000 tons of ore, with 100,000 tons blocked out for stoping, practically all in the Missouri mine. The ores of the Missouri at depth are base, and are deficient in lime and iron, not being sufficiently pyritic to concentrate well. On the advice of an expert, called in for consultation, milling is in abeyance, and efforts will be made to develop suitable smelting ore at depth, instead of erecting a 300-ton concentrator, as had been planned. It is probable that a 4-compartment shaft will be sunk on the Missouri mine, and the Cobreloma tunnel, which reached the main ore body early in 1906, will be continued.

Equipment includes a 300-h. p. steam plant. The power-house, 30x38′, is of stone and iron, and the boiler-house, of wood, is 32x38′. The concentrator, of wood, is equipped with one 8x12″ Blake crusher, 2 trains of rolls, 2 Bartlett tables, 1 slime table and 3 sizers. The smelter, 30x40′ and 3 stories high, is of wood and concrete, connected with the mine by tramway. Smelter capacity is 40 to 60 tons daily, plant having a blast-furnace that makes matte of 55% to 70% in copper tenor, with variable gold and silver values, when in blast. Nearest railroad, 8 miles, is the Arizona & Colorado. Mining costs average about $2 per ton and smelting costs about $5 per ton. Ore was free smelting at

surface, but became refractory at depth, through deficiency in lime and iron, hence the smelter was closed until large bodies of sulphide ore can be opened at depth. Management is considered honest, and the property is regarded as valuable.

MIDLAND GOLD & COPPER MINING & REDUCTION CO. **UTAH.**

Office and mine: care of Albert Swingewood, secretary and treasurer, Hot Springs, Box Elder Co., Utah. Geo. B. Dean, president; F. J. Hirt, vice-president; Daniel Convery, manager. Organized 1904, with capitalization $1,000,000, shares $1 par. Lands, 14 claims, 2 miles from Hot Springs, in the Sierra Madre district.

MID MOONTA COPPER MINES, LTD. **AUSTRALIA.**

Reconstructed, Oct. 29, 1901, as Moonta Central Copper Co., Ltd.

MIDNIGHT MINE. **ARIZONA.**

Office and mine: care of St. Charles Bros., owners, Chloride, Mohave Co, Ariz. Presumably idle.

MIEDNOROUDIANSK MINE. **RUSSIA.**

Mine office: Bogoslovsk, Nijni Tagilsk, Perm, Russia. Is an old and famous copper producer, notable for a great variety of copper minerals, including oxides, carbonates, silicates and phosphates, with occasional native copper, and especially notable for large pieces of massive malachite, one mass of 330 tons having been found in 1836. Was operating in a small way, at last accounts.

MILFORD COPPER MINING & SMELTING CO. **UTAH.**

Office: 5 Walker Bank Bldg., Salt Lake City, Utah. Mine office: Milford, Beaver Co., Utah. Geo. H. Dern, president; Chas. E. Hudson, secretary and treasurer; Frank H. Lathrap, general manager. Organized 1902, under laws of Utah, with capitalization $300,000, shares $1 par. Lands, 11 claims, area 220 acres, lying near the O. K. mine of the Majestic company. Presumably idle.

MILFORD GOLD & COPPER MINING CO. **UTAH.**

Mine office: Milford, Beaver Co., Utah. Idle.

CHAS. S. MILLS & CO. **MEXICO.**

Office and mine: Sierra de Oro, via Horcasitas, Ures, Sonora, Mex. Chas. S. Mills, general manager. Lands, 103 hectareas, known as La Colorada group, also a 6-hectarea millsite, in the Ures district, showing 5 veins, ranging 2′ to 100′ in width, occurring as fissures in porphyry and as contacts between porphyry and phonolite, carrying gold, silver, copper, nickel, cobalt and platinum. Mine is opened by a 100′ shaft and a 440′ tunnel, and is equipped with steam power and a small stamp-mill and concentrator of about 20 tons daily capacity. Nearest railroad is the Sonora branch of the Southern Pacific, 25 miles distant. Employs 25 men, normally, but idle since 1905, owing to the Yaqui Indian uprising.

MILTON COPPER CO. **MICHIGAN.**

Wound up, December, 1902, and property sold for $468.40.

MILTON MINE. **MICHIGAN.**

Office: care of Byron N. White, owner, Spokane, Wash. Lands, 880

acres, between the Norwich and Victoria mines, Ontonagon county, Michigan Has been slightly prospected, but never was a producer.

MILWAUKEE MINING CO. **MONTANA.**

Letter returned unclaimed from alleged mine office, Butte, Silver Bow Co., Montana. Is said to have 6 claims in Butte, including the Florence and Stonewall, and 6 claims in the Argenta district of Montana.

MILWAUKEE-MONTANA NATURAL BRIDGE GOLD & COPPER MINING CO. **MONTANA.**

Office: 127 Third St., Milwaukee, Wis. Letters returned from alleged mine office, Contact, Park Co., Montana. Was promoted by C. T. McElroy, who enjoys a poor reputation.

MILWAUKEE-PALMER MOUNTAIN GOLD & COPPER MINING CO. **WASHINGTON.**

Letter returned unclaimed from former office, 23 Metropolitan Block, Milwaukee, Wis.

SOCIEDAD DE MINAS y FUNDICIÓN. **CHILE.**

Mine office: Carrizal Alto, Freirina, Atacama, Chile. Operates the Portozuelo, Armonia and 12 other mines. The Armonia, about 1,200′ in depth, was a considerable producer, for some years.

MINDOULI MINE. **FRENCH CONGO.**

Mine office: Comba, via Brazzaville, French Congo State. Is a slightly developed prospect, never a producer.

MINE DEVELOPMENT ASSOCIATION. **NEW MEXICO.**

Mine office: Socorro, Socorro Co., N. M. W. H. Bullard, president; H. A. True, secretary; Cony T. Brown, manager. Ores carry values in copper, lead, zinc and silver. Has steam power.

MINERAL CREEK COPPER CO. **ARIZONA.**

Letters returned unclaimed from former mine office, Globe, Gila Co., Ariz.

MINERAL CREEK MINING CO. **ARIZONA.**

Dead. Had copper lands in Pinal county, Arizona, circa 1881.

MINERAL CREEK MINING & SMELTING CO. **WASHINGTON.**

Office: 515 California Bldg., Tacoma, Wash. Mine office: Mineral, Lewis Co., Wash. Adrian F. Kirkpatrick, president; Chas. H. Little, secretary; Harold Howes, superintendent. Organized June 14, 1901, under laws of Washington, with capitalization $2,000,000. Ores carry gold, silver, lead and copper. Has water power and a 20-ton smelter. Presumably idle.

MINERAL HILL CONSOLIDATED COPPER CO. **ARIZONA.**

Office: 331 Fourth Ave., Pittsburg, Pa. Mine office: Tucson, Pima Co., Ariz. Employs 25 men. M. S. Isherwood, president; Boon Ingells, vice-president; C. B. Reeser, secretary, treasurer and superintendent; E. N. Ray, general manager; T. E. Jones, mine superintendent. Organized March, 1904, under laws of Arizona, with capitalization $3,000,000, shares $1 par, as successor of the Azurite Copper & Gold Mining Co.

Lands, 26 claims, 12 patented, area 520 acres, in the San Xavier district, 18 miles southwest of Tucson, including the Azurite group of 13 claims,

which produced $550,000 worth of ore, also the American group of 8 claims, and the Mineral Hill group of 5 claims. The various properties of the company are developed by 74 pits and open-cuts, 48 shafts, mostly shallow, 5 deepest being 130′, 125′, 150′, 345′ and 200′, and by 8 tunnels, mostly short, longest being 250′, with a total of 6,000′ of underground openings, claimed to show 45,000 tons of ore, averaging 10.2% copper and $3 per ton in combined gold and silver values. Main shaft, 345′ deep, March 15, 1906, is to be sunk to 500′, and crosscuts driven from that depth. Has a 150-h. p. steam plant, with hoists good for 350′ and 2,000′. Property has an antiquated smelter, with a 30-ton water-jacket blast-furnace. Mine is said to show a large body of sulphide concentrating ore, averaging circa 3.5% copper, and is considered a promising property.

MINERAL HILL COPPER & GOLD MINING CO. **ARIZONA.**

Apparently succeeded, March, 1904, by Mineral Hill Consolidated Copper Co.

MINERAL HILL COPPER SYNDICATE, LTD. **ARIZONA.**

Controlled by Argyle Mining Co., Ltd.

MINERAL HILL MINING CO. **WASHINGTON.**

Office: 49 West 125th St., New York. Mine office: Conconully, Okanogan Co., Wash. Samuel Lloyd, president; A. R. Lacey, secretary; E. P. Wheeler, superintendent. Has cupriferous silver-lead ores, developed by tunnel. Has steam power and crusher, and plans developing an available water power of circa 4,000 h. p. Idle.

MINERAL HILL MINING & SMELTING CO. **CALIFORNIA.**

Office: 237 Twelfth St., San Francisco, Cal. Mine office: Spenceville, Nevada Co., Cal. C. C. Bitner, manager. Lands, 5 claims, on which considerable development has been secured by a 535′ tunnel. Ores carry gold and copper. Has water power.

MINERAL MINING CO. **OREGON.**

Mine office: Huntington, Baker Co., Ore. H. C. Stratton and A. J. Crook, managers. Has steam power and a small smelter. Presumably idle.

MINERAL MINING & SMELTING CO. **NEVADA.**

Office: Reno, Nev. Mine office: Palisade, Eureka Co., Nev. Lands, sundry claims, on Mineral Hill, midway between Eureka and Palisade, said to show a 16′ vein, carrying auriferous and argentiferous copper and lead ores, giving assays up to $1,108 per ton in gold. In March, 1906, company was said to be building a 60-ton smelter, at Palisade.

MINERAL MOUNTAIN MINING CO. **ARIZONA.**

Dead. Had lands in the Santa Rita Mountains, Arizona.

MINERAL MOUNTAIN MINING CO., LTD. **NEW MEXICO.**

Mine office: Stein's Pass, Grant Co., N. M. Chester W. Maxson, superintendent. Ores carry silver, lead and copper. Has steam power. Idle.

MINERAL POINT MINING CO. **COLORADO.**

Mine office: Marble, Gunnison Co., Colo. L. Hoffman, superintendent, at last accounts. Lands include the Carbonate group, carrying cupriferous gold and silver ores. Has gasoline power and a 50-ton smelter.

MINERS COPPER CO. **MICHIGAN.**

Merged, March, 1899, in Isle Royale Copper Co.

MINES DEVELOPMENT CO. **NEVADA.**

Mine office: Lovelock, Humboldt Co., Nev. John T. Reid, president; Pat Reid, vice-president; E. E. Reid, secretary; preceding officers, R. C. Moore, J. Thies, Peter Ancker, E. B. Loring and John O'Kane, directors. Organized 1905, with capitalization $700,000, shares $1 par. Lands, 23 claims, in vicinity of Black Horse, White Pine county, circa 30 miles east of Ely and 30 miles west of Lovelock, said to show a mineralized formation 300′ wide, carrying copper ores giving assay values up to $50 per ton. Company also owns 925 acres of placer gold ground, near Osceola, White Pine county, Nevada.

MINGINEW COPPER SYNDICATE, LTD. **AUSTRALIA.**

Offices: 216, Mansion House Chambers, London, E. C., Eng. Mine office: Minginew, Western Australia. C. Mullen, secretary. Capitalization, £5,000. Held copper property on lease. Moribund.

MINGUS MOUNTAIN COPPER CO., LTD. **ARIZONA.**

Office: 516 Grant Bldg., Los Angeles, Cal. Mine office: Jerome, Yavapai Co., Ariz. R. A. Thomas, president; Thos. E. Metcalf, vice-president; W. W. Thomas, second vice-president; J. R. Thomas, secretary and treasurer; A. M. McDermott, assistant secretary; preceding officers, W. B. Simmons and W. B. Metcalf, directors; Thomas Brothers & Metcalf, managers. Organized March, 1900, under laws of Arizona, with capitalization $3,000,000, shares $1 par; issued, $2,350,000, Lands, 38 claims, area 750 acres, in process of patenting, in the Black Hills district, showing 3 fissure veins, carrying oxide and sulphide ores, developed by shafts of 370′, 120′ and 250′, with several tunnels, giving total openings of 3,670′, on an ore body having an extreme width of 40′ and traceable 4,000′. The property gives a good surface showing of slightly auriferous copper carbonates, assaying up to 16% copper. Company estimates average value of ores at 8% copper, with small gold and silver values. Has a 50-h. p. steam plant, with 2 hoists, good for 1,000′, and several mine buildings. Is 10 miles from nearest railroad, and lands are fairly will timbered and watered. Company plans continuous development. Management seems good, and property is considered promising.

MINING EXPLORATION CO., LTD. **ARGENTINA.**

Offices: 19, New Union St., London, E. C., Eng. Col. Sir T. Hungerford Holdich, chairman; Wm. Rich, consulting engineer; F. Lumely, general manager; F. A. Bagnall, secretary. Organized Dec. 29, 1900, with capitalization £175,000, shares £1 par; issued, £173,500. Property includes prospecting rights and 2 copper mines, La Victoria and Las Charcas, in Argentina, circa 60 miles from Tinguiririca, Chile, which is the nearest rail point. Management estimates 100,000 tons of ore in sight that will average 8% copper and 5 oz. silver per long ton. It is planned to issue £105,000 in new capital, and from proceeds erect a reduction plant, with mill and smelter capable of treating 30,000 tons of ore yearly. Property and management are well regarded.

MINNEAPOLIS COPPER MINING & MILLING CO. **WYOMING & MONTANA.**

Letters returned unclaimed from former office, Minneapolis, and from former mine offices, Boulder, Mont., and Encampment, Wyo.

MINNEHAHA COPPER-GOLD MINING CO. **WASHINGTON.**

Office: 30 Court St., Boston, Mass. Mine office: Danville, Ferry Co., Wash. Ernest C. Wood, consulting engineer; S. L. Boyer, superintendent. Organized under laws of Maine, with capitalization $50,000, shares $1 par. Lands, 4 claims, area circa 70 acres, opened by several shallow shafts, deepest 250′, and a 206′ tunnel, with a new tunnel started, planned to be 1,124′ long. Mine shows a vein giving assays of $14 to $60 in gold and copper, with a 12″ paystreak assaying $40 per ton. Made first shipment of ore Dec. 15, 1903, to Granby smelter, and made shipments, during 1904, giving net returns of $250 to $400 per car. Property is regarded as promising.

MINNEHAHA MINE. **MONTANA.**

Office and mine: care of Dodge & Kilburn, owners and operators, Basin, Jefferson Co., Mont. Mine, 2 miles from Basin, is opened by a 200′ tunnel, showing two narrow veins, with paystreaks of 8″ giving 18% copper, and 8″ showing 13% copper, 13 oz. silver and $2 gold per ton. Shipped a little ore in 1904. Presumably idle.

MINNESOTA MINE. **MICHIGAN.**

Company wound up. Mine now owned by Michigan Copper Mining Co.

MINNIE GULCH MINING & TUNNEL CO. **COLORADO.**

Mine office: Silverton, San Juan Co., Colo. Ores carry gold, silver and copper. Has steam power. Presumably idle.

MINNIE HEALY MINING CO. **MONTANA.**

Property sold, 1906, to Butte Coalition Mining Co.

MINNIE MABEL GOLD & COPPER MINING CO. **WYOMING.**

Letters returned unclaimed from former mine office, Rambler, Wyo.

MINONG MINE. **MICHIGAN.**

The most important copper property on Isle Royale, Michigan. Has several shafts, deepest 300′. Opened 1874, closed 1879, after making 249 tons, 650 lbs. fine copper. Described in Vol. II.

MINONG RANGE COPPER CO. **WISCONSIN.**

Succeeded, 1906, by Rudolph Land Co. Described in Vol. III.

MINOVACA MINE. **WASHINGTON.**

Mine office: care of Wells & Evans, owners, Bossburg, Stevens Co., Wash. Ores carry gold and copper. Presumably idle.

MINT GROUP. **WASHINGTON.**

Office: care of D. F. Strobeck, owner, Spokane, Wash. Lands, on Gold Hill, near Myers Falls, Washington, show 3 veins, of 8′ to 25′ width, giving assays of 8% copper, 5 oz. silver and $8 gold per ton.

N. MIRANDA y CA. **CHILE.**

Office and mines: Freirina, Atacama, Chile.

MISKWABIK DEVELOPMENT ASSOCIATION, LTD. **MICHIGAN.**

Office: Lake Linden, Mich. Mine office: Phœnix, Keweenaw Co., Mich

Hon. Charles Smith, president; Alfred A. Guck, secretary; Joseph Bosch, treasurer; James Chynoweth, superintendent. Organized February 28, 190[illegible] under laws of Michigan, with capitalization $35,000, shares $1 par. Lands, 1,224 acres, in 5-57-31, 32-58-31 and 33-58-31. Exploration was begun June, 1903, and an amygdaloidal bed, identified as the Kearsarge lode, was located circa 4 miles northeast of No. 1 shaft of the Mohawk mine, the northernmost mine opening on the Kearsarge bed. Several shallow shafts were sunk, showing copper in variable quantities, but lacking persistent values. Main shaft is 170′, showing no copper in the bottom. This lode may not prove the Kearsarge, which possibly lies a quarter mile to the southeast. Diamond drill borings did not prove encouraging, and funds becoming exhausted, the property was closed down, late in 1905.

MINA MISMA MATRACAL. **MEXICO.**

Office and mine: Indé, Durango, Mex. Reinaldo E. Avila, owner and manager. Ores carry copper and silver. Has steam power

MISSOULA COPPER MINING CO. **MONTANA.**

Office: Mullan, Idaho. R. R. McCormick, president; Henry Billings secretary. Development is by a 1,000′ tunnel. Presumably idle.

MISSOURI COPPER CO. **MISSOURI.**

Letter returned unclaimed from former office, 50 State St., Boston.

MISSOURI COPPER MOUNTAIN MINING CO. **MISSOURI.**

Letter returned unclaimed from former office, 632 Century Bldg., St. Louis, Mo. Mine office: Sullivan, Crawford Co., Mo. L. M. Barnard, president; W. H. H. Myers, secretary; M. P. Welton, superintendent. Capitalization $1,000,000, shares $100 par. Lands, 74 acres, freehold, 690 acres leasehold and options on 7,428 acres adjoining, in Crawford, Franklin and Washington counties, Missouri. Mine was worked in a small way, before the middle of the Nineteenth Century. Development is by 4 shafts, and by tunnels of 240′ and 1,000′, showing carbonate ores, with hematite gangue and heavy clay gouge, said to average about 10% copper. Has steam power and concentrator with a Blake crusher, 18″ and 22″ rolls, 4 New Century jigs, Card concentrating table and hydraulic classifiers. Smelter has a 40-ton Allis-Chalmers water-jacket furnace, with Root blower. Country rock is magnesian limestone, ore body having a good gossan capping, with vein showing chalcopyrite and iron pyrites in the sulphide zone. Presumably idle.

MISSOURI & MEXICAN MINING CO. **MEXICO.**

Office: Dwight Bldg., Kansas City, Mo. Mine office: Suaqui de Batuc, Ures, Sonora, Mexico. Geo. A. Wittig, president; Leo N. Leslie, secretary. Lands, 370 acres, near Todos Santos, on the Yaqui river, 9 miles northwest of Suaqui de Batuc, and circa 100 miles from a railroad, said to show ore carrying values of $60 to $300 per ton. Management is undetermined whether to ship ore to a custom smelter, or to build a reduction plant at Suaqui de Batuc. Operations presumably hampered by the uprising of the Yaqui Indians.

MITCHELL DEVELOPEMENT CO. **ARIZONA.**

Liquidated, 1906. Fully described in Vols. IV and V.

MITCHELL MINING CO. **MEXICO.**

Office: 52 Wall St., New York. Mine office: La Dicha, Guerrero, Mexico. Geo. Mitchell, president; Thomas H. Anderson, vice-president; Wm. F. Fluhrer, treasurer; preceding officers, Samuel V. Woodward, Martin F. Morris, B. F. Cole, Robert E. Morrison, Geo. W. Burleigh and Philip S. Dyer, directors; J. McD. Mellen, secretary; F. E. Beecher, assistant secretary; E. D. Elson, general manager; E. E. Noon, mine superintendent; Geo. D. Case, smelter superintendent; Geo. Ross, master mechanic.

Organized April 16, 1902, under laws of Arizona, with capitalization, $5,000,000, shares $10 par; issued, $4,636,000. Direct title to the mines is held through La Dicha Mining & Smelting Co., S. A., organized under laws of Mexico. The Mitchell Mining Co. controls La Dicha & Pacific Railroad Co., which has an issue of $1,000,000 bonds, at 6%, underwritten by large shareholders of the Mitchell, and guaranteed, both principal and interest, by the Mitchell Mining Co. Knickerbocker Trust Co., New York, registrar. Annual meeting, first Monday in April. Further reference to company's finances will be found at the end of this article.

Mining lands, 1,800 pertenencias, area 4,446 acres, include La Dicha, Mitchell, McKinley, Edward VII, Hensey, Odell and Last Chance groups, giving holdings of a solid parallelogram of one by seven miles, with the axis of the tract along the strike of the vein. These lands are in the districts of Bravos and Tavares, State of Guerrero, circa 40 miles in an air-line from Acapulco, one of the best ports on the Pacific. In addition to mineral holdings, there are about 18,000 acres of plantation lands and 164,000 acres of virgin timber lands, latter carrying medium and high-grade woods, including some good oak, yellow pine, and hardwoods, assuring an abundant supply of timber for mining, building and commercial purposes. All lands are owned in fee. The district is fertile and healthy, with an excellent climate, the temperature averaging 74° Fahrenheit. El Rincon ranch, area 18,000 acres, has 8,000 coffee trees, 16,000 cacao trees, pineapples, oranges etc., and also grows corn and other cereals and vegetables, beside grazing large herds of cattle and flocks of sheep, the ranch furnishing all food supplies for the workmen employed at the mines.

The principal mining property is La Dicha group, lying circa 2,000′ above sea-level, comprising various locations, on a continuous vein of sulphide ore upwards of 5 miles in length, continuity being proven by a heavy gossan capping, and also a series of mountain streams that have crosscut the vein down to the sulphide zone, at intervals of a quarter to a half mile, the width of the ore body varying from 150′ to 225′. Country rocks are granite-porphyry, limestone, schists and quartzite, the ore body having a granite footwall and schistose hanging. This ore body has been exposed to a depth of 745′ at one point, by a stream cutting through, and is estimated, by Mr. Mitchell, to contain at least 9,000,000 tons of 4% self-fluxing sulphide ore. In addition to this copper vein, the company has upon its extensive landed holdings promising bodies of coal and iron ore, also veins carrying gold and silver. Below the gossan, and above the chalcopyrite that forms the great bulk of the ore

in La Dicha vein, is a layer of 1′ to 6′ of chalcocite, ranging from slightly disseminated to massive, and assaying 50% to 74% in copper tenor. Tunnel No. 2 shows about 12,000 tons of this extremely rich ore. The vein-matter is essentially pyrrhotite, pyrite and chalcopyrite, forming a self-fluxing ore, requiring no concentration.

The development of the mine has been aided greatly by nature, in cross-cutting the vein at numerous points. The Rio Alcaparosa parallels a considerable portion of the vein, receiving as affluents numerous smaller streams that have cut across the vein at approximately right angles. These streams have worn down their beds, sometimes for hundreds of feet, affording perfect cross-sections of the ore body.

Development is mainly by tunnels, which will afford cheap extraction for some time to come. The mine has 8 shafts and 14 tunnels, with a total of about 14,000′ of openings, all of the shafts and tunnels being in ore. The principal developments are between shaft No. 1 and tunnel No. 8, a distance of about 2,800′, in which are about 3,000′ of shafts, tunnels, crosscuts and winzes, estimated to expose 4,500,000 tons of ore. Shafts are of the following depths; No. 1, 500′; No. 2, 105′; No. 3, 300′; No. 4, 105′; No. 5, 130′; No. 6, 305′. Tunnels are of the following lengths: No. 1, 65′; No. 2, 151′; No. 3, 130′; No. 4, 253′; No. 5, 74′; No. 6, 690′; No. 7, 338′; No. 8, 470′; No. 9, 640′; No. 10, 85′; No. 11, 356′; No. 12, 308′. Tunnels Nos. 4, 6, 8, and 9 have tram-tracks. All shafts are of full 2-comparment size, solidly timbered and equipped with temporary wooden shaft-houses, iron-sheathed. The mine was very carefully sampled, 1905, in 10′ sections, average assays by sections running 2.25% to 8% in copper tenor, with an average of 4%. President Mitchell states to shareholders that the ores of the mine will average 6% copper. In August, 1904, the company claimed to have 861,975 tons of ore blocked out for stoping, with 6,898,636 tons in sight. Owing to mine being opened by tunnels, no heavy mining plant is required. The power plant includes two 40-h. p. and two 120-h. p. hoists, two Rand air-compressors and 12 power drills. The company has a general store and a village of dwellings, small but comfortable, for its workmen. The supply of native labor is ample, and the workmen are fairly efficient, wages ranging from 29 cents to 42 cents gold, per day, for natives.

About 3 miles from the southern end of the mine is the Rio Papagalla, giving an available head of 200′, if reached by a tunnel of about 1,000′ length, which would develop about 8,000 h. p. in the dry season. There also is a smaller water-power available, on the Rio Alcaparosa, for which a 350-h. p. plant is said to have been ordered, for the operation of hoists, power drills, sawmill, ice-plant and electric lighting. It has been estimated that these two streams could be made to develop about 20,000 h. p., or twice the estimated power required for mining and railroad use.

The smelter-site, at a 75′ waterfall, is ample to accommodate a very large reduction plant. The smelter has a 200-ton Mitchell economic hot-blast furnace, and a 300-ton blast-furnace of the same make was being installed in March, 1906. Blast is furnished by 3 Root blowers. The converter plant, of 25 tons daily capacity, has one stand and 3 shells, turning out blister copper of

99% tenor, carrying gold and silver values not stated by company. Wood and charcoal are used for fuel, as well as coke.

La Dicha & Pacific Railroad, controlled by the Mitchell Mining Co., will be 83 miles long, running from the mines, near Chilpancingo, to Puerto Marquez, 3 to 10 miles south of Acapulco. The surveys were completed, and contracts for grading and laying steel were let, early in 1906. Steam will be the motive power, at the start, and the road will be of narrow gauge, but it is planned to widen the gauge and electrify the line, eventually. In addition to handling the Mitchell company's business, the road will secure an extensive and profitable traffic from the sugar haciendas, ranches and timber tracts along its line. The Mexican government has granted exemption from import duties on rails, bridge material, rolling stock and equipment of every nature, for the railroad, and has granted similar exemption on machinery required by the mine.

Production for 1905 is not given, which is a mistake, but is estimated by the Copper Handbook at 3,000,000 lbs., which may be too high. The company was reported to be making 15 tons of 65% matte, equal to nearly 10 tons fine copper, late in 1905, but these figures lack verification.

A 5% dividend was declared December, 1905, but apparently this was a promised dividend only, payable in bi-monthly installments of 1%, the first installment of 1% being paid January 10, 1906, and apparently the second installment was paid in March, 1906, but in May the dividend was passed, the reason given being the cost of enlarging the plant, etc. The Copper Handbook can but repeat its criticism of one year ago, and emphasize its previous statement, that the Mitchell is not yet on a basis where dividends can be paid, without injury to the standing and material welfare of the company. The Mitchell is a big, low-grade property, that will cost millions of dollars to develop and equip to a point commensurate with its size. The high-grade ores can be run through a small smelter, and made to pay small dividends, but such a policy is a seriously mistaken one, and will result disastrously, beyond question. Mr. Mitchell is an experienced mining man, and an even more experienced smelter man, but whatever profit the mine may be able to earn on its present limited production should be put back in the mine —every dollar of it—and in all likelihood more with it, for at least two years to come.

MITSU BISHI GOSHI-KWAISHA. **JAPAN.**

Office: Mitsu Bishi Bldg., Yaesucho Itchome, Kojimachi-ku, Tokio, Japan. Mine offices: as given in detailed mine descriptions following: K. Nambu, president; S. Harada, vice-president; S. Sho, secretary; R. Tayakawa, treasurer; A. Yamada, general manager. Company is an extensive producer of copper, its principal mines being the Yoshioka, Arakawa, Makamine, Osaruzawa, ranking in importance in about the order given, also the Omodani, Ikuno, Sado and other smaller mines.

The Yoshioka mine, at Fukiya-mura, Kawadami-gori, Bitchu, M. Fujioka, general superintendent, has water and electric power, with a 50-ton smelter, and employs circa 1,000 men. This mine was very difficult of access, until a new road was built, by the present owners. The mine, opened circa 1806, has been worked continuously since that time, but never was a large producer, until

taken by the present owners, in 1873. Ore is chalcopyrite, associated with iron pyrites, pyrrhotite and sphalerite, with quartz gangue, and averages 9% copper after dressing. Ore occurs in veins, in country rocks of clayslate, sandstone and schalkstein, traversed by porphyry dykes. Production, 1900, was 1,722,000 momme silver and 1,081,346 lbs. fine copper, and is considerably larger at present, the mine having developed well, during the past 5 years.

The Arakawa and Hisanichi mines, M. Ooye, general superintendent, are at Akawa-mura, Senhoku-gori, Ugo. The Arakawa, formerly known as the Ugaiwa mine, was reopened 1871, and after passing through various hands, was bought by the present owners, in 1896. Country rocks are of Tertiary and Quaternary ages, including hornblende-andesite, liparite and propylite, numerous parallel veins being found in the propylite, with strike approximately northeast and southwest. Production, 1900, was 566,268 lbs. fine copper.

The Hisanichi mine, near the Arakawa, shows 6 principal veins, the largest known as the Ugaisawa, averaging about 24′ width, with one-third pay ore, but occasionally branching into several small veins. The other workable veins range 5′ to 7′ in width. Ore is chiefly argentiferous chalcopyrite, associated with iron pyrites, and frequently carrying native copper, cuprite, chrysocolla, sphalerite and galena, with a quartz gangue. The property has water and electric power and a 50-ton smelter, employing circa 1,200 men. Production, 1900, was 1,734,522 lbs. fine copper.

The Makamine mine, at Kitakata-mura, Higashi-Usuki-gori, Hyuga, was idle for many years, until reopened, circa 1896, by the Mitsu Bishi company. The ore is chalcopyrite, associated with iron pyrites, averaging 3.5% to 4% in copper tenor. The property has been modernized in equipment and methods, and production, 1900, was 1,208,282 lbs. fine copper.

The Osaruzawa mines are at Hanawa, Kazuno, Rikuchu, Japan. K Ishihara, superintendent; K. Okamoto, smelter superintendent; W. Matsuhashi, mine superintendent; K. Ikeda, mill superintendent; T. Kawamura, engineer. These are very ancient mines, opened in the Eighth Century, but were worked for gold only, until circa A. D. 1650, when copper ores were developed. Lands, circa 1,000 acres, also 200 acres miscellaneous lands, in the Kazuno district. Ore is mainly chalcopyrite, with occasional bornite and a little native copper, associated with iron pyrites and small quantities of hematite, sphalerite and galena. Native gold is found also, mixed with the copper ores, and in a quartz fahlband, gold values occurring mainly in the upper workings. Veins are very numerous, ranging from 5″ to 30′ in width, with an average of perhaps 3′. The veins are very persistent in strike, and hold workable to an average depth of circa 500′, traversing Tertiary shales and tuffs, with intrusive augite-andesite and liparite. The Osaruzawa mines are opened by 8 working shafts, deepest 470′, and 7 main tunnels, longest 7,500′, and have upwards of 15 miles of underground workings. The smelter has two 40-ton water-jacket blast-furnaces and a 250-h. p. electric plant, turning out blister copper 99.09% fine. The Osaruzawa mines employ circa 1,000 men, and, in the 1,200 years of operation, have produced immense quantities

of gold, silver and copper. Production, 1902, was 2,448,000 lbs. fine copper, with considerable gold and silver values.

The Ikuno mines, at Ikuno, Tajima, under the general superintendence of T. Hori, employ circa 1,000 men and have steam, electric and water power. These valuable mines were discovered A. D. 807, and in the period 1596-1620, were extensively worked, under the management of the Tokugawa government, being taken over by the Imperial government in 1868, and sold to the present owners in 1896. The three principal mines of this group are the Tasei, Kanagase and Kasei. The Tasei mine has a principal vein averaging 14′ in width, with numerous branches, traversing liparite, propylite and Tertiary tuffs, carrying argentite, native gold and silver, chalcopyrite, malachite, sphalerite, galena and iron pyrites. The Kanagase mine, nearby, has the same country rocks as the Tasei, but is traversed by basalt dykes, a great fault-seam 30′ to 40′ in width, filled with brecciated country rock, showing 6 veins carrying native copper, bornite, chalcopyrite, tetrahedrite, argentite, stibnite, sphalerite, pyrargyrite and galena. The Kasei mine has a country rock of diorite, traversed by liparite and propylite dykes, metalliferous veins occurring in the diorite, and carrying chalcopyrite and native silver, with ores of antimony, lead, zinc and silver. Production, 1900, was 984,355 lbs. fine copper, 1,260,932 momme silver and 29,620 momme gold.

The Omodani mine, at Kami-Anana-mura, Ono-gori, Echigo, is an ancient property, opened A. D. 1350. The mine has numerous small veins, none exceeding 4′ width, carrying bornite, chalcopyrite, sphalerite and galena, all argentiferous and showing occasional native silver. Production, 1900, was 614,438 lbs. fine copper and 103,682 momme fine silver.

The Sawatari mine, at Kitakata-mura, Higashi-gori, Hyuga, adjoins the Hibira mine. Ore occurs, as small lenses, in paleozoic clayslate and sandstone, and production, 1900, was 137,191 lbs. fine copper.

The Sado mines, at Arakawa-cho, Island of Sado, are 425 miles from Tokio, and have Y. Uriu as general superintendent. The property was owned by the Mikado, and operated as a sort of government mining school, until 1898, when bought by the Mitsu Bishi company. The mines have auriferous and argentiferous copper ores, being essentially gold producers, and are equipped with steam, water and electric power, and an exceptionally good plant of modern mining machinery. Production 1905, by all mines, was 12,727,944 lbs. fine copper.

The Mitsu Bishi Goshi-Kwaisha is one of the four arge copper mining companies operating in Japan, and shares with the others the honor of being exceptionally progressive and successful. The success has not been won by the possession of mines of altogether exceptional value, although the company has some excellent properties, but rather has been secured by development along modern lines, with the aid of the best technical skill, and the most modern methods and appliances, in mining and metallurgy. Brains, experience and courage make successful copper mines, in Japan, just as they do in every other country where employed.

MITSUI & CO. **JAPAN.**

Mine office: Funatsu, Yoshiki-gori, Hida, Japan. Bichru Matsuda and C. Tanikawa, superintendents. The Kamioka mine is essentially a silver-lead producer, making a little copper as a by-product. Ores are principally argentiferous arsenopyrite, galena, sphalerite and pyrite, and chalcopyrite associated with occasional malachite and chrysocolla. The property has steam and electric power and a small smelter, employing circa 600 men, production and forces having been materially increased, since bought, 1896, by Mitsui & Co. Production, 1900, was 537,487 kin of lead, 148,670 momme silver and only 8,475 lbs. fine copper.

The Mozumi mine, at Kamioka-mura, Yoshiki-gori, Hida, near the Kamioka mine, is an old property, opened 1573, and is primarily a silver-lead mine, but secures a little copper as a by-product. Production, 1900, was only about one-tenth as much fine copper, as was secured in 1897.

In addition to metalliferous mines, Mitsui & Co., are extensive miners of coal, and their various properties are handled with technical skill, and are equipped on modern and effective lines.

MITTERBERG COPPER CO., LTD. **AUSTRIA.**

Offices: 16, St., Helens Place, London, E. C., Eng. Mine office: Innsbruck Tyrol, Austria. Employs circa 500 men. C. C. Turnbull, chairman; G. B. Elkington, vice-chairman; preceding officers, J. Oppenheim and G. Muir Ritchie, directors; H. Read Smith, secretary; Rood Addie, consulting engineer; Chalmers, Wode & Co., auditors. Organized December 14, 1905, with capitalization £200,000, shares £1 par; issued, £75,000. Shares are listed on the London Stock Exchange.

Lands, 10 mining claims and 10 prospecting claims, area 1,551 acres, also 3,304 acres of timber lands, 15 miles from Bischofshofen, midway between Salzburg and Innsbruck, in the Austrian Tyrol, including the Mitterberger mine. Country rocks are argillaceous Silurian schists, limestone and dolomite, showing 3 parallel veins, known as Josephi, Johanni and Marien, of 6′ to 9′ average width, carrying auriferous, argentiferous and nickeliferous chalcopyrite, associated with arsenopyrite, pyrrhotite, and spathic iron ore, with gangue chiefly of quartz. These veins do not carry values simultaneously, there being only one payable lode in a given cross-section, mineral values switching from time to time. The veins carry high values, in stringers of 1″ to 30″ width, with balance of ore body payable, and averaging perhaps 3% copper. This mine has been worked for many years, and has extensive underground openings, being estimated to show 3,000,000 tons of ore, with circa 400,000 long tons blocked out for stoping. The mine was developed exclusively by tunnels, with small concentrators at the portals, whence selected ore was sent 13 miles, to Ausserfelden, for smelting. The smelter is very old-fashioned, and is to be rebuilt upon a modern scale, and the company plans making a considerable outlay in mining development and in building a new concentrator and smelter, with capacity to make circa 4,500,000 pounds fine copper yearly. Two shafts will be sunk, to open the deeper levels of the

mine. Production, 1905, was 1,254,400 lbs. fine copper. Management is considered good, and the property is regarded as decidedly promising.

MITTERBERGER KUPFERGEWERKSCHAFT. **AUSTRIA.**

Succeeded, December, 1905, by Mitterberg Copper Co., Ltd.

MIZUSAWA MINE. **JAPAN.**

Owned by Furukawa Copper Co.

MOAB COPPER MINING CO. **N. UTAH.**

Office and mine: Moab, Grand Co., Utah. Organized Nov. 2, 1905, under laws of Utah, to take over sundry claims in the La Sal district.

MOBILE MINE. **GEORGIA.**

An old and idle mine, slightly developed, in Fannin county, Georgia.

MINA MOCTEZUMA. **MEXICO.**

Mine office: San José de Guadalupe, Durango, Mex. Roman Gaitau, owner and manager. Is opened by tunnel.

MOCTEZUMA-ARIZPE DEVELOPMENT CO., S. A. **MEXICO.**

Office and mine: Apartado 130, La Cananea, Sonora, Mexico. J. P. Hallihan, president; James A. Kirk, vice-president; G. B. Cash, secretary; V. R. Walling, treasurer; F. S. Wilhelm, manager. Organized November 20, 1903, under laws of Arizona, with capitalization $1,000,000, shares $5 par; issued, $100,000. Lands, 765 claims, lying circa 17 miles southeast of Cananea, including the Alacran mine, of 75 pertenencias; El Rey de Cobre, of 125 pertenencias; Victoria, of 24 pertenencias, and Palo Seco, of 86 pertenencias. The Alacran mine has a 150′ shaft, showing oxidized ore of $100 to $120 per ton value, on the 100′ level, and sulphide ores, worth up to $150 per ton, on the 150′ level. Two carloads of second grade ore, shipped April, 1906, gave smelter returns of $75 per ton.

MOCTEZUMA COPPER CO. **MEXICO.**

Office: 20-99 John St., New York. Mine office: Nacozari, Moctezuma, Sonora, Mexico. Employs circa 600 men. Jas. Douglas, president; A. C. James, vice-president; Geo. Notman, secretary and treasurer; Jas. S. Douglas, superintendent; Geo. Kingdon, mine superintendent; Al. Berner, mill superintendent; D. S. Giddings, engineer; Dr. A. Sandberg, metallurgist; Geo. M. Douglas, superintendent motive power. Organized under laws of West Virginia, with capitalization $3,000,000. Is a close corporation, owned and managed by the members of the firm of Phelps, Dodge & Co.

Lands, sundry claims, area circa 2,000 acres, in the Moctezuma and Arizpe districts of Sonora, include the Pilares de Nacozari mine, 6 miles east of Nacozari, also the Juárez and Nicolas ranches, area circa 35,000 acres, the mine lying in a rough, hilly country, near the divide between the Yaqui and Oposura rivers. The ores occurs in a broad friction zone, in which the original rock has been broken into pieces ranging in size from gravel up to masses of many tons in weight, the country rock in this crushed zone being porphyry, which also is the matrix of the ore, this being mainly auriferous chalcopyrite, with occasional bornite, associated with iron pyrites, with no clearly defined footwall and with a hanging-wall dipping at an angle of about 80°. There is a small outcrop of rich carbonate ore, but croppings are mainly red-stained porphyry, showing

considerable low-grade hematite. The leached zone is about 20′ in depth only, with pay-ore coming in at 60′. The ore body apparently is about 800′ wide by 1,500′ long, on surface, the area increasing at depth. The matrix is a fine-grained silicious rhyolite, and the ore averages about 2.7% in copper tenor, as mined, before concentration. Development is mainly by tunnel, the 3,500′ Porvenir tunnel having 20″ gauge railway tracks, with extensive drifting at either side, with storage bins in a 25x100′ chamber, to which ore is milled down from the upper workings. The main working shaft is 600′ deep, with 4 levels opened, showing some enormous stopes, one of which, No. 4, on the 3d level, is 85′ high, 125′ wide and 150′ long. The mine has shafts of 2,570′ aggregate depth, and tunnels with a total length of 5,100′, the underground workings exposing an immense amount of ore, with 1,500,000 tons blocked out for stoping.

The 600-ton concentrator, in 2 sections, is equipped with 2 Blake crushers, 4 sets of 54x3″ roughing rolls, 2 sets of finishing rolls, 24 revolving screens, 48 Hartz jigs, ten 5′ Huntington mills, 56 six-foot Frue vanners, 20 Bartlett tables, hydraulic classifiers and 7 settling tanks. Slimes from the settlers are worked by vanners exclusively, and rolls are used in crushing, to obviate sliming, as far as possible. Tailings are reground and treated on Frue vanners. The power equipment of the concentrator includes five 50-h. p. motors, eight 30-h. p. motors and one 20-h. p. motor. This concentrator, designed by Dr. L. D. Ricketts, saves upwards of 90% of the original ore values, although the ore is not easily amenable to treatment. The matter of increasing the mill to a daily capacity of 1,000 tons is said to be under consideration.

Mine, mill and smelter are connected by a 6-mile narrow-gauge railway, and it is planned to rebuild and extend this line.

The smelter, five miles from the mine, has two 42x130″ elliptical water-jacket furnaces, of the Copper Queen type, flanked by tilting wells that can be tilted both front and rear. A 75-h. p. dynamo furnishes blast. Fumes from converters and furnaces pass into an 8′ horizontal steel flue, leading to a 750′ brick flue, discharging into a 70′ brick stack. The converter department has 2 stands, with 96x114″ shells, of the Copper Queen type. The smelter was closed September, 1904, upon completion of the railroad line from Cos to Nacozarí, all concentrates going to the Douglas Reduction Works of the Copper Queen, 77 miles distant, over the Nacozari Railroad, owned by Phelps, Dodge & Co., and built for the Moctezuma mine.

The Moctezuma has steam and gas power, mainly the latter, which has proven more economical. The gas plant has Loomis-Pettibone generators, making both producer and water gases, which are stored in separate gasometers of 15,000′ and 5,000′ capacity, respectively, gases being mixed in due proportions before use. The consumption of fuel is under 3 lbs. of very inferior wood per h. p.-hour. The power plant has 8 single-cylinder 100-h. p. Crossley gas engines, of the 4-cycle type, with 18.5″ cylinders and 24″ stroke, making 200 revolutions per minute, each direct-connected to a 65-kw. direct-current generator, and one 200-h. p. Crossley engine driving a 150-kw. generator. Power for the various departments of the mine, concentrator and smelter, is furnished

including stibio-domeykite, mohawk-whitneyite, mohawkite and keweenawite, the two latter being peculiar to this mine and described in the chapter on mineralogy. The most important commercially is mohawkite, this occurring in considerable quantities in the upper north drifts of No. 1 shaft, the vein ranging 3″ to 3′ in width and being mineralized at the crossing of the amygdaloid bed, and for an indefinite, but usually short, distance, on either side. The mohawkite and allied arsenides of copper occasionally occur massive, but commonly are disseminated in an arenaceous gangue, and after hand-cobbing carry values of $100 to $150 per ton. On the 6th and 7th levels the mineral contents of the principal fissure vein are small, and apparently the production of mohawkite for the future will be trifling.

The Mohawk has 5 shafts, numbered from north to south. New mine openings, 1905, aggregated 10,812′. The mine is running circa 50 power drills. The use of concrete stringers was begun in 1905, in shafts 1, 2, 3 and 4, at the bottom of the wooden timbering formerly installed, and No. 5 has concrete stringers from surface. The wooden sleepers in the four older and deeper shafts will be replaced by concrete, from time to time, as the wood decays.

No. 1 shaft, located circa 1,500′ south of the point where the outcrop of the lode passes over the Mohawk's northern boundary, was 1,400′ deep at the end of 1905, and shows material improvement, being the best shaft of the mine at the end of the year.

No. 2 shaft, located 1,100′ southwest of No. 1, was 1,300′ deep at the end of 1905, and shows a marked improvement below the 12th level.

No. 3, lying 1,100′ southwest of No. 2, ended 1905 at a depth of 950′, and opens poor ground, but the rock is softening in the two bottom levels, and an improvement at greater depth, such as has occured in the two shafts next north, is looked for, with reasonable certainty.

No. 4, lying 1,300′ southwest of No. 3, was 900′ deep at the end of 1905, and opens good ground from surface down.

No. 5, the southernmost shaft, lying 1,800′ south of No. 4, and begun 1904, ended 1905 at a depth of 300′, with a satisfactory showing of copper.

The shafts are of uniform size, 8x18′ inside of timbers, with solid cribbing through the overburden, and are to have identical equipments. Shafts 1, 2 and 4 have duplicate Nordberg compound conical-drum hoists, good for a depth of 6,000′, and similar hoists are to be installed, eventually, at Nos. 3 and 5. Shafts 1, 2, 3 and 4 have combination shaft-rockhouses, fitted with 12x24″ Nordberg engines and rock-crushers. The lode runs 15′ to 18′ wide, or about the same as at the Wolverine, and is somewhat richer than the Wolverine was at similar depth, but not so rich as the Wolverine now is in its bottom workings.

A power plant, near No. 2, serves both shafts 1 and 2. This has an engine-house and boiler-house of mine-rock, with redstone trimmings. Shafts Nos. 3 and 4 have individual engine-houses and boiler-houses, the buildings at No. 4 being of redstone. The equipment at No. 5 is temporary throughout, to be replaced later. No. 5 shaft has an old straight-face drum from No. 1, and a temporary rockhouse with one crusher. A 60-drill Ingersoll-Sergeant air-compressor is located at No. 4 shaft, and the old compressor at No. 3 shaft

is maintained as an auxiliary. Miscellaneous surface improvements include a machine-shop, smithy, combination carpenter shop and warehouse, 30x40′ office building, and a well-equipped hospital.

The Mohawk mill, at Gay, standing opposite the Wolverine mill, is near the mouth of the Tobacco river, on Traverse Bay, Lake Superior. A 20,000,000-gallon triple-expansion Snow pump furnishes water for both mills, the pumphouse standing near the river, from which water is taken. The mill is 178x206′ in size, of steel frame, sheathed with iron, on foundations of sandstone, quarried from the company's own lands. A steel trestle, 350′ long and 50′ in extreme height, leads into the mill, loaded cars being pulled up this incline by a winding engine. The mill has 4 stamps, the fourth having been completed November, 1905, but only 3 heads are in commission, one being compounded, giving two Nordberg steeple compound heads and two single cylinder heads. The mill has 3 sets of auxiliary crushing rolls, with fixed bearings, to reduce the oversize material from the mortar-boxes of the heads, this averaging 20% to 25% of the gross amount of rock stamped, giving the single-stage stamps a daily capacity of 500 tons each, working on the soft rock of the Kearsarge lode. Mineral from the wash discharges automatically into pipes, and is sluiced into the basement of the mill, where it is shoveled into 1½-ton mineral cars, having 14-mesh perforated steel bottoms, allowing the draining out of water, after which the cars are weighed, then lifted by a cage elevator and dumped into bins. The bin-house has four compartments, each having a cement floor, with steam pipes underneath, for drying out the remaining moisture from the wash. The mineral goes from the bin-house into self-dumping steel mineral cars, in which it is hauled to the Michigan smelter, at Houghton. The mill is equipped with the latest washing machinery and has a Chilean regrinding mill and trolley carriers for barrel copper. A steel boiler-house, adjoining the mill, has four 250-h. p. Stirling water-tube boilers. The townsite at the mill, named in deserved honor of Jos. E. Gay, long and actively identified with honest and successful copper mining in the Lake Superior district, has streets, water mains and hydrants, with a number of substantial dwellings, occupied by employes. The wharf, on Traverse Bay, a short distance from the mill, is 30x300′ with 14′ of clear water alongside, and is fitted with coal-hoists and storage sheds, ample for the needs of both the Mohawk and Wolverine mines.

Production, 1905, was 659,291 tons rock hoisted and 586,305 tons rock stamped, yielding 12,577,785 lbs. mineral, which smelted into 9,387,614 lbs. fine copper, giving a net yield of 16.01 lbs. fine copper per ton, equivalent to a metallic percentage of only 0.8005%, as compared with 17.75 lbs. per ton in 1904 and 21.79 lbs. per ton in 1903. For 1906 a small gain in metallic contents of rock treated should be shown. Cost, per ton hoisted, 1905, was $1.23, and per ton stamped was $1.38. Total cost of fine copper secured was 9.77 cents per pound for ordinary charges, or 10.91 cents per pound, including construction account. Net earnings for 1905 were $412,173.13, after extraordinary expenditures of $131,687.12 for construction account, and for the purchase of sundry timber lands. A consid-

erable surplus was brought forward from the previous year, giving a surplus of $796,114.42 on Dec. 31, 1905, and dividends of $2 in January, and $3 in July, 1906, were paid, and the company should end the year with a larger surplus than was brought forward.

The Mohawk suffered a great loss, in February, 1906, by the death of Mr. John Stanton, the president of the company from its organization, but the management remains in the capable and trustworthy hands of those who have been so long and so honorably associated with Mr. Stanton, in the industry of mining Lake Superior copper for the benefit of the shareholders.

MOHAWK MINING CO **UTAH.**

Mine office: Bingham Canyon, Salt Lake Co., Utah. F. S. Bascom, president; E. B. Critchlow, vice-president; Edward W. Duncan, secretary and treasurer. Organized November 28, 1902, under laws of Utah, with capitalization $150,000. Lands, 7 claims, in the West Mountain district.

MOIRA COPPER CO. **ALASKA.**

Office: Milwaukee, Wis. Mine office: Ketchikan, Alaska. Lands, 7 claims, adjoining the Niblack Copper Co., on Prince of Wales Island. Company is said to plan extensive development, during 1906.

MOJAVE COPPER CO. **CALIFORNIA.**

Letter returned unclaimed from former mine office, Red Rock, Cal.

MOLLIE GIBSON GROUP. **BRITISH COLUMBIA.**

A prospect, at Menzies Bay, Discovery Passage, Nanaimo district, British Columbia. A promising ore body was encountered, in 1901. Since idle.

MOLLIE STARK COPPER MINING CO. **WYOMING.**

Office: care of Dr. G. A. Thomas, 92 North State St.,Chicago, Ills. Mine office: Encampment, Carbon Co., Wyo. J. M. Thomas, Jr., general manager. Has a 400′ tunnel, opening a contact vein, and has shipped a little ore to the Penn-Wyoming smelter. Presumably idle.

MONA & PARYS MINES, LTD. **WALES.**

Offices: Amlwch, Anglesey, Wales. R. Bridson, secretary. Organized Jan. 13, 1899, with capitalization £75,000, shares £1 par; issued, £58,000. Debentures, £20,000 first mortgage, at 6%, and £10,000 second mortgage, at 7%. Lands, 1,067 acres, with improved water-frontage, warehouses, ochre works, tramways, etc. Makes a little copper, by cementation, from mine-waters. Mines in this district were worked by the Romans. The Parys mine was opened 1768, and made 3,000 tons of copper in 1784. Present production is 25 to 50 tons fine copper yearly.

MONARCH CONSOLIDATED GOLD & COPPER MINING & SMELTING CO. **COLORADO.**

Office: 1932 Thirteenth St., Boulder, Colo. T. S. Waltenmeyer, president and treasurer; Charles A. Wolcott, vice-president; F. H. Wolcott, secretary. Organized September, 1903, under laws of Colorado, with capitalization $1,000,000, shares $1 par. Has an authorized bond issue of $300,000, running 3 years, at 6%. Lands include the Buena and Pilot mines, at Sunshine, Colorado, which are gold properties, and the Coppe

King group, on the south fork of the Grand river, in Middle Park, Grant county, Colorado, latter having an area of 1,740 acres, carrying 3 miles of the strike of a copper vein said to be of 15′ to 50′ width. The Copper King group has a 25-h. p. hydro-electric installation, and developments are suspended, awaiting the building of the Moffat railroad, under construction in 1906.

MONARCH COPPER MINING CO. **CALIFORNIA.**

Office: 326 Post St., San Francisco, Cal. Letter returned unclaimed from alleged mine office, Callahan, Siskiyou Co., Cal. C. F. Pattey, president; Chas. K. Dickenson, secretary and treasurer. Organized under laws of South Dakota, with capitalization $200,000, shares $1 par. Lands, claimed to be 640 acres, claimed to show two veins carrying cuprite, melaconite, malachite, azurite, chalcocite, bornite and chalcopyrite, claimed to be opened by a 200′ tunnel, claimed to give assays of 11.25% copper and $2.50 gold per ton, with traces of silver. Also is claimed to have a vein of auriferous and argentiferous galena. Was put on the market by that notorious bunco-steerer, "Baron" W. E. von Johannsen, hence presumably is an addled egg.

MONARCH GOLD & COPPER MINES, LTD. **BRITISH COLUMBIA.**

Dead. Letters returned unclaimed from former office, Portland, Oregon, and former mine office, Nelson, B. C.

MONARCH GOLD & COPPER MINING CO. **ARIZONA.**

Office: 219–53 State St., Boston, Mass. John B. Hathaway, president; Geo. E. Warren, secretary; G. P. Morrill, treasurer; C. L. Barker, general manager. Lands, sundry claims, in the Big Bug district of Yavapai county, Arizona, showing slightly cupriferous gold ores. Idle several years.

MONARCH MINES & SMELTERS CORPORATION. **UTAH.**

Office: care of Hon. A. B. Lewis, 100 Broadway, New York. Organized 1904, with capitalization $30,000,000, to take over sundry Nevada and Utah copper properties. Cannot be learned that any work has been done.

MONARCH MINING, MILLING, TUNNEL, TRANSPORTATION & POWER CO. **COLORADO.**

Mine office: Idaho Springs, Clear Creek Co., Colo. Geo. E. McClelland, superintendent. Property is the Freeland mine, carrying ores of gold, silver, copper and lead. Has electric power.

MONARCH MINING & SMELTING CO. **ARIZONA.**

Office: care of H. O. Thomas, secretary, Peoria, Ills. Mine office: Wickenburg, Maricopa Co., Ariz. P. G. Rennick, president; Walter H. Kirk, vice-president; preceding officers, H. J. Charles, E. R. Dosier, E. L. Martin and Geo. I. Root, directors; C. W. Platt, superintendent; J. B. Tomlinson, consulting engineer. Organized August, 1904, under laws of Arizona, with capitalization $1,000,000, shares $1 par. Lands, 4 claims, held under working bond and lease, in the Black Rock district, 9 miles southeast of Wickenburg, opened by a tunnel showing ore giving assays of 3% to 20% copper and $3 to $15 gold per ton, with average values of $8 per

ton. Company claims to have 50,000 tons of ore in sight. Management is said to plan building an electric power plant, between Wickenburg and Hot Springs Junction.

MONARCH-SMUGGLER MINING & REDUCTION CO. COLORADO.

Office: 521 Commonwealth Bldg., Denver, Colo. Earl W. Kelly, president and general manager; Fred S. Sweet, vice-president; J. Horace Shepard, treasurer; preceding officers, Eda D. Kelly and Oscar Sorsonsen, directors; Charles E. Dawson, secretary. Organized January 2, 1906, under laws of Colorado, with capitalization $3,000,000, shares $1 par. Lands, 14 claims, area 137 acres, in the Harmon district of Grant county, Colorado, circa 50 miles northwest of Denver, said to show surface ores assaying $6 to $98 per ton. Company planned beginning work in spring of 1906, on a projected 1,500′ tunnel, designed to cut the main vein at 800′ depth.

MOND NICKEL CO., LTD. ONTARIO.

Offices: 39, Victoria St., London, S. W., Eng. Mine office: Victoria Mines, Algoma, Ont. Works office: Clydach, Wales. Dr. Ludwig Mond, F. R. S., chairman; Robert Mathias, secretary; Dr. Bernard Mohr, general manager; Hiram Hixon, mine manager. Organized Sept. 20, 1900, with capitalization £600,000, in 300,000 ordinary shares, par £1, 50,000 deferred shares, par £1, and 50,000 cumulative 7% preference shares, par £5. Paid a 6% dividend on ordinary shares, 1905.

Lands, 3,350 acres freehold and 1,550 acres leasehold under 3-year option, in the townships of Blezard, Denison, Snider and Garson, Sudbury district, Algoma, Ontario, carrying cupriferous and nickeliferous pyrrhotite, quite extensively developed. The Victoria mine, which is the principal producer, has a 650′ vertical 3-compartment shaft, 4x12′ inside of timbers. The 8th level, at the bottom, shows the ore bodies maintaining both width and grade. The North Star mine, lying northeast of the Creighton mine, in Snider township, has some development also. The Victoria mine shows 2 lenses of nickeliferous pyrrhotite and chalcopyrite, with east and west strike, connected by stringers, in schistose diorite near a granite contact. The Victoria mine has a separate shafthouse and rockhouse, at No. 1 shaft, with 5-drill and 10-drill Rand straight-line air-compressors, hoists, etc.

An 11,000′ Bleichert aerial tram connects the Victoria mine with the roast-heaps and smelters, the tramway being self-operating, owing to steep incline secured. The works also have direct rail connection with the Canadian Pacific railway. The smelter building, of steel, sheathed with corrugated iron, has 2 water-jacket blast-furnaces, 2 stands of converters, traveling cranes, and a power plant with five 100-h. p. return tubular boilers, Riedler air-compressor, 2 Connersville blowers with direct-connected engines, and a 125-kw. dynamo.

The refining works are in the Swansea Valley, at Clydach, Wales. The bessemerized copper-nickel matte from the smelter is dead-roasted and treated with dilute sulphuric acid, which permits the extraction of about two-thirds of the copper and 2% of the contained nickel. The residue, after drying, assays 45% to 60% nickel, and is treated, in charges of 500 kgs.,

with water-gas, in a reduction tower, at a temperature of about 300° Centigrade. This tower has shelves, and the ore is removed from shelf to shelf by automatic rakes, the lower shelves being cooled. After treatment in the reduction tower, the charge is transferred to a volatilizing tower, and treated with carbon monoxide, at a temperature of about 100° C. The residue therefrom is returned to the reducing tower, and the charge goes forward and back between the two towers, for 10 to 15 days, and when 60% of the nickel has been volatilized, as nickel carbonyl, the residue of the charge is returned to the roasting furnace. The nickel carbonyl is treated in a decomposing apparatus, wherein the metal is recovered in granules, assaying 99.4% to 99.8% nickel. The copper is turned out as bluestone.

MONEY METALS MINING CO. **ARIZONA.**

Mine office: Prescott, Yavapai Co., Ariz. W. H. Rench, president. Lands, 8 claims, fairly timbered, in the Black Hills district, 3 miles south of the Yaeger Canyon Copper Co., and 6 miles from a railroad, giving good assay values in gold, silver, copper and lead, from surface ores. Company plans sinking a shaft to a possible depth of 1,400′.

MONITOR MINE. **MONTANA.**

Mine office: care of Hon. H. J. Rossi, Wallace, Idaho. Mine office: Saltese, Missoula Co., Mont. E. P. Spaulding, consulting engineer; Thos. Jay, superintendent. Lands, sundry claims, near the Richmond mine, circa 6 miles east of Mullan, Idaho. Development is by a 300′ shaft, planned to be sunk to 500′ depth, said to show a 12′ vein of ore carrying gold and copper values up to $60 per ton. Vein is 3′ to 12′ wide, showing considerable native copper and chalcopyrite, assaying up to 20% copper and $4 to $10 gold per ton. Mine shipped some ore, of about $25 per ton average value, during 1905. Property is worked during the summer seasons only.

MONITOR MINE. **MONTANA.**

The Butte mine of this name is owned by the Anaconda Copper Co.

MONITOR MINING CO. **BRITISH COLUMBIA.**

Letters returned unclaimed from former mine office, Alberni, B. C.

MONTAGNAT MINE. **NEW CALEDONIA.**

Mine office: Diahot, New Caledonia. Is said to have an ore body of considerable size, slightly developed. Idle.

MONTANA & ARIZONA CONSOLIDATED COPPER CO.

Charter surrendered and company disincorporated, circa 1902.

MONTANA & ARIZONA COPPER MINING CO.

Letter returned unclaimed from former office, 68 State St., Boston, Mass.

MONTANA BELLE COPPER CO. **ARIZONA.**

Office: 1604 Arapahoe St., Denver, Colo. Chas. H. Pierce, president; A. L. Emberson, general manager; A. R. Bain, secretary and treasurer; preceding officers, A. T. Cronin and Luther Bain, directors; Chas. A. Smith, consulting engineer. Organized under laws of Arizona, with capitalization $800,000, shares $1 par. Lands, 3 claims, area 60 acres, in the Ellsworth district, 1 mile west of Cunningham Pass and 6 miles north of Welton, Yuma county, Arizona, in the Harcuvar Mountains, 6 miles from a railroad, said

to show a vein of 8′ to 25′ width, with a good gossan outcrop, carrying oxidized ores to depth of 100′ and 150′, with sulphides below. Advertising of the company is too flamboyant, and very misleading on many points, the statements as to dividends and advances in price of mining shares, etc., being entirely incorrect.

MONTANA CONSOLIDATED MINING CO. **MONTANA.**

Letters returned unclaimed from former office, 79 Wall St., New York, and former mine office, Saltese, Missoula Co., Mont.

MONTANA COPPER & GOLD MINING CO. **MONTANA.**

Controlled by International Copper & Gold Co.

MONTANA COPPER MINING CO. **MONTANA.**

Dead. Lands were near Helmville, Lewis & Clark county, Montana.

MONTANA COPPER & SILVER MINING CO. **MONTANA.**

Office: Butte, Montana. Mine office: Clancey, Jefferson Co., Mont. Capitalization $200,000, shares $10 par. Lands, 4 claims, 2 miles from Clancey, opened by a 200′ shaft. Active development was resumed April 1, 1906.

MONTANA & MICHIGAN MINE. **MONTANA.**

A property by this name is said to have a 700′ tunnel, showing ore assaying up to 19% copper, on Canyon creek, Teton county, Montana.

MONTANA MINERAL LAND DEVELOPMENT CO. **MONTANA.**

Office: Ferguson Blk., Pittsburg, Pa. Mine office: Basin, Jefferson Co., Mont. Thomas C. Kelly, president; John G. Mizer, vice-president and treasurer; Frank J. Weixel, secretary; James Humes, general manager. Organized 1902, under laws of Montana, with capitalization $3,500,000, shares $1 par. Lands, 19 claims, area circa 300 acres, in the Cataract district. Country rocks are granite, showing fissure veins carrying sulphide ores, mainly chalcopyrite. One vein, of 100′ width, is opened by an 850′ shaft, and tunnels of 525′, 1,400′, 700′ and 800′, with 3,425′ of lateral openings, giving assays of 6% copper, 6% to 12% lead, 15 oz. to 30 oz. silver, and 20 cents to $3 gold per ton. Company estimates 50,000 tons blocked out for stoping. Has a steam plant of 200 h. p., with two 75-h. p. hoists, good for 2,000′ depth, and a 4-drill Ingersoll-Sergeant air-compressor. Has a 20x40′ log machine shop, 20x30′ smithy, 24x30′ carpenter shop, and 30x80′ engine and boiler house. Concentrator, of logs, is 35x120′, with a 7x10″ Blake crusher, 1 set of rolls, eight 3-compartment jigs and 2 Wilfley tables. Property has produced 7,000 tons of ore, sold for $166,238, and is regarded as promising.

MONTANA MINING & DEVELOPMENT CO. **MONTANA.**

Idle and practically dead. Fully described in Vol. V.

MONTANA ORE PURCHASING CO. **MONTANA.**

Office: 31 Nassau St., New York. Mine office: Butte, Silver Bow Co., Mont. F. August Heinze, president and general manager; John MacGinnis, vice-president; Arthur P. Heinze, secretary; Stanley Gifford, treasurer. Organized 1883, under laws of Montana, with capitalization $2,500,000; debentures, $1,000,000 first mortgage 6% bonds. Is controlled by the United Copper Co., which holds 76,791 shares out of 80,000 shares issued, and owns the

entire issue of bonds. Mining property was sold, 1906, to Butte Coalition Mining Co.

MONTANA SCOTCH BONNET COPPER & GOLD MINING CO. **MONTANA.**

Office: Davenport, Wash. Mine office: Cooke, Park Co., Mont. C. A. Wilcox, superintendent. Lands include the Cora, Maggie and Jennie V. groups, carrying ores of gold, silver and copper, in the New World district, 70 miles from a railroad. A shareholder complains that management will give him no information, and that he considers the company a swindle.

MONTANA VERDE COPPER CO. **MONTANA.**

Letter returned unclaimed from former office, 21 Park Row, New York. Mine office: 82 Owsley Blk., Butte, Silver Bow Co., Mont. Jos. Johnston, general manager; N. F. Norman, secretary and treasurer. Organized 1902, under laws of South Dakota, with capitalization $2,500,000, shares $1 par. Lands, 16 claims, in the Bernice district of Jefferson county, 30 miles from Butte, showing a large body of low-grade ore, traversed by numerous small veins, carrying high values in copper and gold, developed by tunnels of 275′ and 350′. Has steam power and a 10-stamp mill. Presumably idle.

MONTANA ZINC CO. **MONTANA.**

Mine office: Butte, Silver Bow Co., Mont. A. L. Strasberger, president; C. A. Wimpfheimer, vice-president; Clarence B. Wisner, second vice-president and general manager; Maurice Isenberg, third vice-president; A. L. Bailey, secretary and treasurer; Bayard T. Spaulding, assistant manager; Chas. W. Leimer, superintendent. Capitalization $300,000, but company is said to plan increasing same to $2,500,000. Property is the Emma mine, having an 800′ shaft, showing a mineralized formation of about 300′ width, carrying up to 2% copper only, but with considerable zinc values and small gold values. Had an option on the property of the Alice Gold & Silver Mining Co., but allowed same to lapse. The Alice mill is held under lease, and was remodeled, 1905, for treating zinc ores. The mill, early in 1906, was treating circa 125 tons daily, of Lexington zinc ore, furnished by La France Copper Co.

HILARIO MONTAÑO. **MEXICO.**

Office and mine: Guachinango, Jalisco, Mex. Lands, 8 pertenencias, showing strong veins, carrying auriferous and argentiferous copper ore, with antigua workings and recent development by present owner.

SOCIÉTÉ DES MINES DE CUIVRE DE MONT CHALMERS. **AUSTRALIA.**

Voluntarily wound up, May 1, 1901.

SOCIETA ANONIMA DELLE MINIERE DI MONTECATINI. **ITALY.**

Offices: 49, Piazza Santa Apostoli, Rome, Italy. Mine office: Bocchegiano, Grosseto, Italy. Works office: Leghorn, Italy. Employs circa 700 men. I. Castelbolognesi, president; Alfred Deschars, vice-president; Alfredo Santori, secretary; Paolo Marengo, general manager; Paolo Cerrina, superintendent: Guglielmo Vallada, engineer. Organized 1888, with capitalization 5,000,000 lire, shares 100 lire par. Paid dividends, 1899-1902, of 82 lire per share.

Holdings include the Montecatini, Fenice Massetana, Capanne Vecchie and Bocchegiano mines, all very ancient properties, worked successively by the Etruscans, Romans, Goths and Italians. Massa Marittima, 20 miles distant, on the Mediterranean railroad, is the nearest station. The gangue of the Montecatini ores is a brecciated red porphyry, carrying chalcopyrite, bornite, disseminated and massive chalcocite and occassional native copper, the ores averaging about 3.5% in tenor, as mined. Present development is by one shaft of 125 metres and 5 tunnels, giving about 8,000 m. of underground openings, with about 500,000 tons of ore in sight. The property is equipped with steam power and has a concentrator with 5 crushers.

The dressed ores sent to the smelter average about 36% from the Montecatini mine, and about 11% each from the Massetana and Bocchegiano mines. The smelter, at Leghorn, has 4 reverberatory furnaces and a converter plant, also a sulphuric acid plant for the utilization of the sulphur, ores of 3.5% tenor in copper carrying about 40% sulphur. For the 7 years, 1895-1901, the company produced 257,332 tons of ore of all grades, the average being, for first grade, 10.67% copper, second grade, 3.44% copper and 45% sulphur: third grade, 2.67% copper, the average of all grades for 7 years being 3.68% copper and 28.15% sulphur. Production, 1905, was as follows, in metric tons: Montecatini mine, 1,197 tons ore, averaging 10.17% copper, yielding 122 tons fine copper; Bocchegiano mine, 3,138 tons first grade ore, averaging 8.88% copper tenor, producing 279 tons fine copper, 13,158 tons second grade ore, averaging 3.09% copper, producing 408 tons fine copper, and and 441 tons of copper precipitate, averaging 69.25% copper, producing 305 tons fine copper; Capanne Vecchie, 572 tons fine copper, from precipitate; Fenice Massetana, 940 tons of selected ore, averaging 10% copper, producing 94 tons fine copper, and 693 tons fine copper from precipitate, giving a total production by the Montecatini company, for 1905, of 2,673 metric tons, equal to 5,892,895 lbs. fine copper. Production, 1903, was 3,086,440 lbs. fine copper, showing an increase of nearly one hundred per cent, in two years. The company is well managed, both as to finances and physically, with a magnificent market at its doors, and is likely to prove an increasingly important producer, in the years to come.

MONTE CRISTO CONSERVATIVE MINING CO. **ARIZONA.**

Mine office: Paradise, Cochise Co., Ariz. Lands, sundry claims, circa 2 miles north of Paradise, at a site formerly known as Gayleyville. Idle.

MONTE CRISTO GOLD & COPPER CO. **UTAH.**

Letters returned unclaimed from former office, Salt Lake City, Utah, and former mine office, Milford, Utah. Described in Vol. V.

MONTE CRISTO MINE. **MONTANA.**

Letter returned unclaimed from former mine office, Rimini, Mont.

MONTE CRISTO MINING CO. **ARIZONA.**

Office and mine: Metcalf, Graham Co., Ariz. Henry Brigham, president; Refugio Murillo, secretary and general manager. Lands, 5 claims, on Chase creek, about 2 miles above Metcalf, carrying a fissure vein in porphyry, showing 3′ to 4′ of oxidized ores, assaying up to 45% copper, opened by

a shallow shaft and tunnels of 100′ and 200′. Made small shipments of ore to Shannon smelter, in 1904. Presumably idle.

MONTEREY GOLD & COPPER MINING CO.

Dead. Disappeared from former office, 11 Broadway, New York.

MONTEREY GOLD MINING CO. **WASHINGTON.**

Letter returned unclaimed from former mine office, Bolster, Wash.

MONTEREY SMELTING & REFINING CO. **MEXICO.**

Described under Mexican title, Compañía Minera Fundidora y Afinadora de Monterrey, S. A.

COMPAÑIA MINERA FUNDIDORA y AFINADORA DE MONTERREY, S. A. **MEXICO.**

Office and works: Monterey, Nuevo León, Mexico. Capitalization was increased, 1903, to 8,000,000 pesos. Has an extensive smelting plant, and does a large custom business, on silver, lead and copper ores. Production, 1903, was 215,568 lbs. fine copper.

MONTE RUBIO GROUP. **SPAIN.**

Under lease to United Alkali Co., Ltd.

MONTEZUMA COPPER CO.

Letter returned unclaimed from former office, Albuquerque, N. M.

MONTEZUMA COPPER MINING CO. **ARIZONA.**

Mine office: Globe, Gila Co., Ariz. Lands, 17 claims, near Globe, several giving a promising showing of ore. Is sinking a vertical shaft.

MONTEZUMA LEAD CO. **MEXICO.**

Mine office: Santa Barbara, Parral, Chihuahua, Mexico. A lead and zinc mine, carrying incidental values in gold and silver, with 0.5% to 1% copper. Production is circa 100,000 tons of ore yearly.

MONTEZUMA MINING CO. **MEXICO.**

Mine office: La Cananea, Sonora, Mexico. Lands, sundry claims, circa 16 miles from La Cananea.

MONTEZUMA & THE WHIZZERS GOLD-COPPER MINE. **SOUTH DAKOTA.**

Office and mine: Deadwood, Lawrence Co., S. D. Owned by J. T. Gilmore, manager, and the C. W. Carpenter Estate. Lands, 13 claims, patented, area 135 acres, in the Whitewood district, showing a prominent gossan capping, with several cupriferous veins, of which one has an estimated average width of 45′, and has been traced 3,000′. Has been worked for gold, to nearly the water-level, and has produced considerable low-grade fluxing ore, sent to the Golden Reward smelter, at Deadwood. Idle at last accounts, but negotiations in progress for sale.

MONTGOMERY GOLD LEAF MINING CO. **NEW JERSEY.**

Apparently succeeded by Pahaquarry Copper Mining Co.

MONTPELIER COPPER MINING & SMELTING CO. **IDAHO.**

Mine office: Montpelier, Bear Lake Co., Idaho. Fredk. W. Rose, superintendent. Property includes the Duke, Emerald and other claims, carrying argentiferous copper ore. Idle for some years.

MONTREAL & BOSTON CONSOLIDATED MINING & SMELTING CO., LTD. **BRITISH COLUMBIA.**

Practically absorbed by Dominion Copper Co., Ltd., which gave one share of its stock for 2 shares of Montreal & Boston, and held upwards of 75% of Montreal & Boston stock issue, at beginning of 1906. Fully described in Volume V.

MONTREAL GROUP. **UTAH.**

Held by Nevada-Utah Mines & Smelters Corporation, at last accounts.

MONTT HERMANOS. **CHILE.**

Office and mine: San Juan, Freirina, Atacama, Chile. Principal properties are the Quebradita, 300′ deep, opened 1834; Rosario, 290′ deep, opened 1854; Manto, 160′ deep, opened 1846, and San José, 180′ deep, opened 1851.

MONUMENT COPPER MINING CO. **MONTANA.**

Organized August, 1902, by Alex. S. Christie, et al., of Butte, Montana, with capitalization $75,000. Lands are on Bloody Dick Creek, 30 miles from Red Rock, Beaverhead county, Montana. Presumably idle.

MOON-ANCHOR COPPER MINING CO. **WYOMING.**

Office and mine: Encampment, Carbon Co., Wyo. L. W. Tennant, president and general manager; W. J. Wernli, secretary and treasurer. Organized 1901, under laws of Wyoming, with capitalization $1,000,000, shares $1 par. Lands, 3 claims, area 60 acres, on Green Mountain, in the Upper Platte district, said to show a 50′ fissure vein of sulphide ore, giving assays up to 10% copper, developed by a 200′ shaft. Has steam power. Presumably idle.

MOON GOLD MINING CO. **CALIFORNIA.**

Office: Valley Springs, Cal. Mine office: Richey, Amador Co., Cal. J. B. Lucas, vice-president and general manager. Has two shafts, of 100′ and 140′. Vein-stuff is a sulphide mineralization of diabase and talcose schist, carrying gold and copper values. Presumably idle.

MOONLIGHT MINE. **MONTANA.**

Owned by Washoe Copper Co.

MOONMERA COPPER MINING CO., LTD. **AUSTRALIA.**

Offices: 69, Queen St., Brisbane, Australia. Mine office: Moonmera, via Rockhampton, Queensland, Australia. T. G. Dewar, secretary; Samuel Phillips, general manager. Lands, 4 leases, area 200 acres, showing 4 ore bodies, of which 2 are partly developed. Country rocks are sandstone and granite, veins having an arenaceous gangue. Gold is found in the oxidized zone, but values turn to copper at a little depth, ores being mainly sulphide, with a little oxidized ore and some native copper, latter sometimes occurring as flakes and small sheets, but commonly disseminated in small particles. The property also shows large bodies of low-grade carbonate ores. The ores average 1.75% to 2% copper only, but by rejecting about 70% of the ground broken, can furnish 5% ore to the mill, which makes concentrates carrying circa 17.5% copper and 9 dwts. gold per long ton. The mine is opened by shafts of 50′ and 93′, and by 5 tunnels, of 90′ to 280′ length.

MOONTA CENTRAL COPPER CO., LTD. **AUSTRALIA.**

Offices: 30, Moorgate St., London, E. C., England, and Adelaide, South Australia. Mine office: Wallaroo, Yorke Peninsula, South Australia. A. Lesser, chairman; John Alex. Russell, secretary; John S. Scott, manager. Organized Oct. 29, 1901, as a reorganization of the Mid-Moonta Copper Mines, Ltd., with capitalization £110,000, shares £1 par, in 50,000 cumulative preference 6% shares and 60,000 ordinary shares. Debentures, £1,400 issued, at 10%. Lands, 152 acres, held under 99-year lease, expiring 1991, from the South Australian government. Has 4 shafts, deepest 432,' said to show considerable medium grade ore, with steam power and a small concentrator. Presumably idle.

MOOSE MINE. **MONTANA.**

Owned by Boston & Montana Copper & Silver Mining Co.

SOCIEDAD MINERA DEL MORADO. **CHILE.**

Owns the Arenillas mine, opened 1860, in the department of Freirina, Atacama, Chile. Has a small matting furnace. Idle for several years.

FRANCISCO MORÁN. **MEXICO.**

Office and mine: Mineral de Asientos, Aguascalientes, Mexico.

MORENCI COPPER CO. **ARIZONA.**

Letter returned unclaimed from former office, 44 Broadway, New York. Mine office: Morenci, Graham Co., Ariz. Stephen Panish, president; Geo. M. Penny, secretary. Originally known as the Arizona Gold Mining & Milling Co.; reorganized as Gold Cliff Mining & Milling Co.; re-reorganized as Morenci Copper Co. Owned the Micawber claim, hence, presumably is "waiting for something to turn up", to permit another reorganization.

MORENCI COPPER MINES, LTD. **ARIZONA.**

Merged, 1903, into Clifton Consolidated Copper Mines of Arizona., Ltd.

MORGAN-ARGENTINE MINING CO. **UTAH.**

Office: 50 West Second South St., Salt Lake City, Utah. Mine office: Peterson, Morgan Co., Utah. Employs 3 men. Herbert Pembroke, president and general manager; W. H. Croft, vice-president; A. B. Pembroke, secretary and treasurer; Earle Pembroke, engineer; preceding officers, John Croft and S. J. Pembroke, directors. Organized 1900, under laws of Utah, with capitalization $500,000, shares 1 cent par. Annual meeting, third Tuesday in May. Lands, 11 claims, area 175 acres, in the Argentine district, showing fissure veins in Carboniferous limestone, one vein, ranging 2' to 10' in width, being opened by a shaft of 175', with 2,000' of underground workings, showing ore carrying values in copper, lead, silver and gold.

KUPFERBERGWERK MORGENSTERN. **GERMANY.**

Mine office: Kupferberg, Schlesien, Germany. Employed circa 250 men, at last accounts.

MORMON GIRL MINING CO. **ARIZONA.**

Property, in the Cave Creek district of Maricopa county, Arizona, was leased to North American Exploitation Co., which was promoted by the Western Trust & Guaranty Co., 327 New York Life Bldg., Chicago, Ills., which company reported, 1905, that the property was free from debt, but

numerous attachments were filed, 1905, and property was sold for $400. Described in Volume V.

MORNING STAR MINE. **CALIFORNIA.**

An old and idle mine, in the Mogul district, north of Markleeville, Alpine county, California, showing ores assaying up to 17% copper, 49 oz. silver and $32 gold per ton.

MORNING STAR MINING CO. **ARIZONA.**

Letter returned unclaimed from former mine office, Dewey, Arizona.

MORONG MINE. **VIRGINIA.**

Mine office: Virgilina, Halifax Co., Va.

MORRIS MINING CO. **WYOMING.**

Office: Morris, Ills. Letter returned unclaimed from former mine office, Battle, Carbon Co., Wyo. F. H. Mattison, president; J. R. Collins, vice-president; G. A. Leach, secretary; A. Hollenbeck, treasurer; J. T. Brown, general manager. Lands, sundry claims, on Nellie Creek, 1 mile below Battle, adjoining the Continental Copper Mining Co. Is tunnelling to strike a 7′ vein, giving assays of 5% copper in a 50′ shaft.

MORRISON MINES, LTD. **BRITISH COLUMBIA.**

Absorbed, 1904, by Montreal & Boston Consolidated M. & S. Co.

MOSCOW MINE. **UTAH.**

Office: care of Matthew Cullen, owner and manager, Salt Lake City, Utah. Mine office: Milford, Beaver Co., Utah. Daniel Ferguson, superintendent. Mine, 15 miles northwest of Milford, was shipping weekly, at end of 1905, one to two cars of silver-lead and gold-copper ores, said to average about $1,000 per car in gross values.

MOTHERLODE COPPER MINING CO. **VIRGINIA.**

Office: 18 Broadway, New York. Mine office: Virgilina, Halifax Co., Va.

MOUNT ÆTNA GOLD & COPPER MINING CO. **UTAH.**

Lands, supposedly in Utah. Presumably idle.

MOUNTAIN COPPER CO., LTD. **CALIFORNIA.**

Offices: 3, Lombard St., London, E. C., Eng. American agency: 60 Beaver St., New York. Mine office: Keswick, Shasta Co., Cal. Works office: Martinez, Contra Costa Co., Cal. Wm. Keswick, chairman; preceding officer, Sir Andrew Noble, Bart., Walter Scott, C. W. Fielding, A. Fellows and H. J. Wenham, directors; A. Frewer, secretary; Lewis T. Wright, general manager; W. F. Kett, assistant general manager; T. J. Jones, mine superintendent; J. A. Black, smelter superintendent; J. J. Murray, assistant smelter superintendent; W. Cole, railway superintendent; C. C. Jones, engineer.

Organized May 10, 1902, (as reconstruction of company of same name, organized December, 1896,) with capitalization £250,000, shares £1 par. Debenture stock, £750,000, par £3, remainder of £1,000,000 issued, at 6%. All available funds are to be applied to redemption, pro rata, until £750,000 of the debenture stock shall have been paid off, after which the remaining £250,000 will be exchanged, at par, for shares or partly for shares and partly for cash; £1 per bond was repaid Jan. 16, 1905, Last dividend was 10s.,

in 1901, and largest dividend was 20s., in 1899. Net earnings for 1905 were £158,168—a remarkably good showing, considering the disadvantages under which the company labored.

The mine, 10 miles northwest of Redding, near the top of Iron Mountain, was worked originally, in a small way, for the gold and silver in the gossan capping. Landed holdings are extensive, and in addition to the old mine there is a large sulphide ore body to the north, known as the Hornet, carrying circa 6,000,000 tons of low-grade ore. The main ore body is a solid, pyritic mass, approximately 100′ to 400′ wide, 800′ long and 500′ deep, with a gossan capping of 100′ to 300′ width. The ore gives average returns of 5% to 5.5% copper, about 2 oz. silver and slightly under $1 gold per ton, and is mainly chalcopyrite, associated with pyrite and pyrrhotite, occurring in a shear zone in meta-rhyolite. The mine is worked by pillar-and-stall, and depleted stopes are filled with rock, quarried just west of the mine. As much ore is left in the pillars, the mine undoubtedly will be robbed, eventually, by open-pit work. Ore reserves are estimated at about 500,000 tons, and extensive diamond drill borings have failed to show further deposits of high-grade ore. As the ore is strongly pyritic, there has been considerable trouble from mine fires, but every precaution is taken to prevent these, and to extinguish such as occur, through spontaneous combustion. The Hornet ore carries only 2% to 2.5% copper, but is rich in sulphur, which runs 47% to 50%. The mine and smelter are connected by an 11-mile narrow-gauge electric railway, traversing a rugged country, and having an average grade of nearly 2%, the elevation gained being circa 2,000′.

The Keswick Smelting Works, 8 miles from the mine, are in the cañon of Spring Creek, less than a mile from the Sacramento river, and have both broad and narrow-gauge railway lines, connecting with the Southern Pacific railroad. The smelter has 5 water-jacket blast-furnaces, of 390 tons daily capacity each, with 11 Wright circular calcining furnaces, 3 stands of converters, with 9 Parrott shells, 3 briquetting machines and a complete sampling plant. Ore is heap-roasted in open air, 8 to 10 weeks being required for roasting, the raw ore carrying 45% sulphur and the roasted ore 7%, a steam-shovel loading ores from the roast-heaps. The fines and ore from the roast-heaps are calcined in the Wright turret roasters, and briquetted by three machines, which also handle flue-dust and calcined granulated matte, using lime for a binder. The furnaces have settlers, with slag overflow to ladle cars, and a slag railway, the matte pouring into iron casting moulds on a slow-moving belt-conveyor, and passing under jets of water to chill the pigs, which are dumped into barrows and hoisted to the charging floor. The first-fusion matte is of 25% to 30% copper tenor, and the second-fusion matte is roasted and blown up to white metal, running into settlers and thence in ladles by travelling crane to the converters. The blast-furnaces have rotary blowers, driven by one Allis-Chalmers cross-compound, one Risdon cross-compound and a small auxiliary straight-line engine, steam being furnished by 3 Babcock & Wilcox boilers and 1 Heine water-tube boiler, all fired with oil. Air from the blowers is heated by stoves fired with oil, before entering the tu-

yeres, the hot blast effecting great ecomonies and giving a close approach to ideal pyritic smelting, with a very small consumption of coke in the furnaces. The converter plant has an air-compressor driven by a 500-h. p. Allis-Chalmers engine, and the 3 stands are controlled hydraulically, from a single elevated platform. Linings for the shells are tamped by a power drill, ingeniously fitted with a special tamping-iron, bolted into the chuck. Fumes from furnaces, converters and roasters, are carried through dust-chambers, and flue-dust is briquetted and resmelted. In connection with the smelting plant are large machine shops, a foundry and smithy. Electric power, generated 80 miles distant, is used at a cost of ¾ of one cent per h. p.-hour. The smelter also does custom work, buying gold ores of all grades, used for fluxing the company's own ores. Considerable cement copper is secured, by precipitation from the charged waters of the mine. Operation of the smelter has been greatly hampered by suits of neighboring ranchers, and other professional followers of agriculture and litigation. Eventually the United States Circuit Court of Appeals decided, early in 1906, for the company, which is permitted again to operate its smelter at Keswick, after nearly a year's idleness.

For the treatment of the low-grade Hornet ores, special works were required, and these have been built at Martinez, on San Francisco Bay. The works and business of the San Francisco Chemical Co. were taken over, as the nucleus of the new plant, which is one of the best planned and most extensive acid works in existence, having cost approximately $1,000,000. The plant has a daily capacity of 350 tons, and was put in commission early in 1906. The Hornet ores, which are low in copper, but rich in sulphur, are burned, and the sulphur fumes collected is lead-lined chambers and transformed into sulphuric acid, the cinder remaining after the roasting being leached for its copper content. The acid will be sold crude, to some extent, but the bulk of the production is to be used as the basis of commercial fertilizers, for which there is an enormous demand in the rich fruit and agricultural districts of California and the other Pacific coast states. In addition to the acid plant, the Martinez works will do some general smelting, and will treat Tonopah ores, among others.

Production 1905, was circa 10,000,00 lbs. fine copper only, as compared with nearly twice that amount two years previously, and a high-water record of almost four times as great an output in a single year. The Mountain Copper Co., Ltd., seems to have been followed by an avenging deity, for five years past. Almost every misfortune that could befall a mine has befallen the Mountain, the list of troubles including mine fires, labor troubles, and litigation. All of these have been survived, and the property is now in shape, thanks to its Martinez plant, and the favorable settlement of the litigation over smelter fumes, to make more copper and larger profits than for some years past. The management is efficient and honest, and the property, notwithstanding the partial exhaustion of its high-grade ore bodies, is one of great value.

MOUNTAIN KEY MINE. **NEW MEXICO.**

Office: care of W. C. Chandler, owner and manager, Pinos Altos, Grant Co., N. M. Is one of the oldest mines in Grant county. Has a 700′ shaft, and produces auriferous and argentiferous copper sulphides. Has steam power, and owner is said to plan installing a small mill and smelter.

MOUNTAIN LAKE MINING CO. **UTAH.**

Office: Salt Lake City, Utah. J. L. Rawlins, president and general manager; E. A. Wedgwood, secretary. Organized 1896, under laws of Utah, with capitalization $50,000, shares 10 cents par. Lands, 24 claims, area circa 400 acres, in the Big Cottonwood district of Salt Lake county, showing 2 contact veins, between diorite and limestone, said to be 100′ wide and traceable 2,000′, carrying bornite and chalcopyrite, giving average assay values of 2.5% copper, 2 oz. silver and $1 gold per ton, opened by a 100′ shaft and 5 tunnels, longest 1,100′. Presumably idle.

MOUNTAIN LION GOLD & COPPER CO. **MEXICO.**

Office: La Cananea, Sonora, Mexico. Organized 1905, with capitalization $50,000, to take over sundry mining lands, of circa 400 pertenencias area, the Magdalena district of Sonora, Mexico.

MOUNTAIN VIEW COPPER CO. **OREGON.**

Dead. Sold its lands, in the Waldo district, 1903, to Vulcan Copper Co.

MOUNTAIN VIEW DEVELOPMENT CO. **ARIZONA.**

Mine office: Bisbee, Cochise Co., Ariz. Geo. Bennett, president; H. M. Woods, vice-president; W. D. Kinsey, secretary; Chas. Trotman, treasurer. Organized 1903. under laws of Arizona, with capitalization $1,000,000, shares $1 par. Lands, 9 claims, 3 miles northwest of Bisbee, opened by 2 shallow shafts and a tunnel. Ores carry occasional lead values, and a small test shipment gave returns of 16.74% copper and 100 oz. silver per ton.

MOUNT ANDREW MINING CO.

Office: 52 William St., New York.

MOUNT ANDREWS MINE. **ALASKA.**

Sold, 1905, to Britannia Copper Syndicate.

MOUNT BABINDA MINE. **AUSTRALIA.**

A Queensland property, that produced a little ore, 1902, dressed by hand-cobbing to 23% copper and 20 oz. silver per ton, with small gold values. Presumably idle.

MOUNT BAKER & SHUKSAN MINING CO. **WASHINGTON.**

Office: 35 Hinkley Blk., Seattle, Wash. Mine office: Maple Falls, Whatcom Co., Wash. J. Conaway, president; C. M. Walsh, secretary; Geo. B. Conaway, superintendent. Lands, sundry claims, opened by a 320′ tunnel, showing ore giving good assay values in copper and gold. Has an air-compressor and 2 power drills, and is said to plan developing an available water power.

MOUNT BULGA COPPER CO. **AUSTRALIA.**

Property is sundry slightly developed copper lands, in the Orange division of New South Wales. Presumably idle.

MOUNT CHALMERS COPPER MINES, LTD. **AUSTRALIA.**

Voluntarily wound up, May 1, 1901.

MOUNT DIAMOND COPPER CORPORATION, LTD. **AUSTRALIA.**

Offices: 18, Broad Street Ave., London, E. C., Eng. E. Fewings, chairman; L. G. Brown, secretary. Lands, 240 acres, leasehold, 5 miles northeast of Wandie goldfields, South Australia, carrying a vein traceable 900′ on surface, opened by a 100′ shaft, showing chalcopyrite associated with iron pyrites, with quartz gangue, in a vein of 2′ to 25′ width, with well defined walls. Property considered promising, but company apparently moribund.

MOUNT DONALDSON COPPER CO., LTD. **TASMANIA.**

Offices: 38, Gracechurch St., London, E. C., Eng. Col. H. J. Byrne, chairman: D. B. Cotton, secretary. Organized March 28, 1899, with capitalization £150,000, shares £1 par. Lands, 159 acres, on Mt. Donaldson, Corinna, Tasmania. Idle for several years.

MOUNT EDDY MINING & DEVELOPMENT CO. **CALIFORNIA.**

Letters returned from former office, San Francisco, Cal. Lands were 14 claims, near Sisson, Siskiyou county, California.

MOUNT FISHER PROPRIETARY CO. **AUSTRALIA.**

Planned building a smelter, at last accounts. Presumably idle.

MOUNT FLORA MINE. **AUSTRALIA.**

Mine office: Mackay, Queensland, Australia. Made 17 tons of copper, in 1901. Idle.

MOUNT FRASER COPPER MINES (N. S. W.), LTD. **AUSTRALIA.**

Voluntarily wound up, June, 1902.

MOUNT GARNET & CHILLAGOE EXPLORATION CO. **AUSTRALIA.**

Dead.

MOUNT GARNET FREEHOLD COPPER & SILVER MINING CO., LTD. **AUSTRALIA.**

Company liquidated, and property taken over by bondholders.

MOUNT GARNET RAILWAY & FREEHOLD MINES. **AUSTRALIA.**

Voluntarily wound up, 1903.

MOUNT GODDARD COPPER MINING CO.

Office: Fresno, Cal. Moribund.

MOUNT HOPE MINE. **AUSTRALIA.**

Owned by New Mount Hope Copper Mining Co., Ltd.

MOUNT JUKES PROPRIETARY MINING CO. **TASMANIA.**

Office: care of T. L. Hood, agent, Hobart, Tasmania. Lands, sundry claims, in the Mt. Jukes field, Tasmania.

MOUNT LYELL BLOCKS COPPER CORPORATION, LTD. **TASMANIA.**

Reorganized, 1903, as Mt. Lyell Blocks Mining Co. (No Liability.)

MOUNT LYELL BLOCKS MINING CO. (NO LIABILITY.) **TASMANIA.**

Offices: 47, Queen St., Melbourne, Australia. Mine office: North Mount Lyell, Montagu Co., Tasmania. Employs 220 men. Colin Templeton, chairman; preceding officer, Alfred Tolhurst, Thos. Harvey and Alex. Campbell, directors; Thos. Rollason, secretary; Robert Ferguson, general manager. Or-

ganized March 20, 1903, under laws of Victoria, as a reconstruction of the Mount Lyell Blocks Copper Corporation, Ltd., with capitalization £300,000, shares £1 par; paid, in 19s. 9d. Half yearly meetings, February and August.

Lands, 70 acres, held under mineral lease, also 60 acres timber lands and 150 acres miscellaneous lands, including a millsite, giving total holdings of 288 acres, in the North Mount Lyell district, in addition to which the company has the right to mine, for 7 years, on adjoining lands of the Mount Lyell Consols, on a royalty of 40% of net profits. The property shows sulphide ores, giving assays up to 6%, occurring in a 30′ bed of conglomerate rock, but this ore body is not being worked at present. Two ore bodies now under development carry native copper, in argillaceous schists, locally termed clays, as the schists are very soft. These ore bodies were estimated to carry 3% copper, but revised figures by the company give average values of 2.15% copper. Development is by the 240′ Balance shaft and the 450′ Main shaft, also by the 1,638′ Consols tunnel and 1,680′ Office tunnel, these openings being estimated to show 100,000 long tons of ore. The ground is very soft, turning to clay when weathered, and is exceedingly treacherous, requiring heavy timbering and constant watchfulness. The copper is carried in minute particles, disseminated quite evenly through the schist, and is concentrated quite easily. During 1905 the policy of the mine was changed, in some important particulars, and work is now done on contract, as far as possible, this giving cheaper mining costs. The heavy cost of timbering also has been reduced somewhat.

The concentrator, of 350 tons daily capacity, began work August, 1904, and gave very unsatisfactory results at first, but some minor changes have resulted in bringing the mill to a much higher state of efficiency. The mill, of steel frame, has 10 gravity stamps, 20 Wilfley and Phœnix-Weir tables, canvas tables and 12 Frue vanners. Miscellaneous improvements at the mine include a small sawmill and framing-mill for mine timbers. The Mount Lyell & North Mount Lyell Railway is distant 1 to 5 miles from the mine. Fuel is cordwood, costing 10s. per cord.

The first half of 1905 showed a working profit of £651 11s. 11d. which would have been much larger but for the caving in of the mine. At the end of 1905 the mill was treating circa 1,000 tons ore weekly, and producing 15 to 20 tons of fine copper therefrom. The management plans bringing the mill to its full capacity, of about 2,000 tons weekly, during 1906, and on that basis should produce circa 200 long tons fine copper monthly.

MOUNT LYELL-COMSTOCK COPPER CO., LTD. **TASMANIA.**

Title changed, 1903, to Lyell Comstock Consolidated Copper Co., Ltd.

MOUNT LYELL CONSOLS. (NO LIABILITY). **TASMANIA.**

Offices: Equitable Bldg., Collins St., Melbourne, Australia. N. Madden, secretary; H. S. Muir, mine manager; D. J. Mackay & Co., 138, Leadenhall St., London, E. C., Eng., British agents. Capitalization, £126,000. Lands, 50 acres on Mt. Lyell and 40 acres on Mt. Darwin. Latter tract has been prospected, and former is under a 7-year lease to Mt. Lyell Blocks Mining Co., on royalty of 40% of net profits secured.

MOUNT LYELL COPPER ESTATES, LTD. **TASMANIA.**

Offices: 85, Gracechurch St., London, E. C., Eng. Mylius Cohen, chairman; F. W. Eccardt, secretary. Organized July 19, 1899, with capitalization £150,000, shares £1 par; issued, £103,435. Lands, 4 leases, on Mt. Lyell, have been abandoned. Moribund and liquidation probable.

MOUNT LEYLL EXTENDED CO. (NO LIABILITY). **TASMANIA.**

Offices: 138, Leadenhall St., London, E. C., England, and Equitable Bldgs., Collins St., Melbourne, Australia. M. Gilmore, mine manager; J. P. Madden, secretary in Melbourne; H. M. Taylor, secretary in London. Capitalization £150,000. Lands, 30 acres on Mt. Lyell and 80 acres on Mt. Darwin. Idle and apparently moribund.

MOUNT LYELL MINING & RAILWAY CO., LTD. **TASMANIA.**

Offices: 39, Queen St., Melbourne, Australia, and Palmerston House, Old Broad St., London, E. C., Eng. General manager's office: Queenstown, Tasmania. Mine office: Gormanston, Montagu Co., Tasmania. On Jan. 1, 1906, employed 2,094 men. Has two boards of directors. Bowes Kelly chairman; Wm. Knox, M. P., vice-chairman; preceding officers, Wm. Jameson, J C. Syme and Lindsley Tulloch, members of Australian board; John Ball Ball, chairman; Sir John A. Cockburn, vice-chairman; D. J. Mackay, A. Williamson and J. Dowling, members of London board; Alfred Mellor, secretary at Melbourne; Edwin Habben, secretary at London; Robert C. Sticht, general manager; A. Lewis Dean, chief metallurgist; W. H. Wesley, assistant metallurgist; E. Carus Driffield, railway superintendent; W. T. Batchelor, mine superintendent; A. N. Macnicol, chief mechanical engineer; P A. Mackay, superintendent of chemical works; Dr. F. J. Howell, distributing superintendent; A. G. S. Williams and Thomas Woodward, auditors.

Organized Aug. 11, 1903, under laws of Victoria, as an amalgamation of an old company of the same name and the North Mount Lyell Copper Co., Ltd., with capitalization £1,300,000, shares £1 par; issued, £1,200,000. Debentures, £140,000, at 5%. Dividends were £150,000 in 1904 and £205,000 in 1905, and present company and its predecessor have paid total dividends, to end of 1905, of £1,351,574. Half yearly meeting, May; annual meeting, November.

Lands, 3 consolidated leases and 33 ordinary leases, from the crown, for 20-year and 30-year periods, area 1,537 acres mining lands, also 565 acres smelter-sites, with total landed holdings of 2,102 acres, in the West Coast mining district of Tasmania. Country rocks are schist, conglomerate, quartzite and sandstone, ore bodies occurring as massive lenses in the schist, near conglomerate contacts, the lenses having a generally NW. and SE. trend. There are 15 known lenses, of which 6 are under development, these having average dimensions, at the Mt. Lyell mine, of 270′ width, 660′ length and a proven depth of 730′, and at the North Mt. Lyell mine, 100′ width, 180′ length and 600′ proven length. Ores are of two varieties, the Mt. Leyll ores consisting of massive pyrite carrying disseminated bornite and chalcopyrite, with average values of 2.18% copper, 1.85 oz. silver and 0.055 oz. gold per long ton, while the North Mt. Lyell mine carries silicious sulphide ores, including

chalcocite, bornite and chalcopyrite, with quartzose schist gangue. There are occasional occurrences of native copper and tetrahedrite, but the ores of commercial importance are almost exclusively sulphide. In addition to the ores previously enumerated, the Mt. Lyell has large bodies of very low-grade sulphide ores, averaging circa 0.65% copper, 2 oz. silver and 0.0725 oz. gold per ton, which doubtless will become valuable in time. The North Mt. Lyell ores are higher in copper tenor than those of the main mines, but are decidedly refractory, unless heavily fluxed, carrying 15% to 20% alumina and 60% to 75% silica. An average analysis of ores, made circa 1903, gave, in addition to copper, silver and gold contents, 40.3% iron, 46.5% sulphur, 4.4% silica, 2.5% barium sulphate and 2% alumina.

The Mt. Lyell has a 260′ blind shaft, and tunnels of 320′ and 1,450′, while the North Mt. Lyell has blind shafts of 550′ and 325′, with tunnels of 850′ and 780′. The mines have a total of circa 15 miles of underground workings, estimated to show 4,500,000 long tons of ore, with 1,500,000 long tons of ore blocked out for stoping in the Mt. Lyell and North Mt. Lyell mines, with about 350,000 tons blocked out in various other mines. Mining is done open-cast, in terraces, at the Mt. Lyell and its principal subsidiary mines, underground extraction, at these properties, being confined largely to the removal of the richer patches of ground encountered during exploitation. A traveling crane, at the open-cast mines, assists in extraction, and is a utilization of a valuable invention that might be employed elsewhere to advantage, where steam-shovels are not used. The overburden of the Mt. Lyell main ore body is estimated at 1,500,000 cubic yards, all of which must be stripped, eventually. The mine is lighted by electricity and 2 diamond drills are used steadily, in probing the ground. The North Lyell ores are much richer, and show considerable ore remaining that averages better than 10% copper, the North Lyell furnishing circa 25% of the total ore production, this ore being the richest in Tasmania, but refractory in smelting, unless blended with the basic ores of the Mt. Lyell. Recent developments at the North Mt. Lyell are of a very encouraging nature, where an important new ore body was discovered, 1905, on the 700′ level.

The mining equipment includes 4 underground hoists, at various blind shafts, of 30-h. p. to 40-h. p. each, good for 800′ depth, two Corliss cross-compound air-compressors, of 40 drills aggregate capacity, and 34 power drills. Buildings include 13 smithies, of various sizes, a 40x50′ machine shop, 17x30′ carpenter shop, boiler and compressor-house, engine-house, warehouse, office, locomotive roundhouse and numerous dwellings for employes. The company also owns and operates three sawmills, at various points, for the preparation of mine timber, and lumber for general building purposes. In addition to the ore mines there are extensive silica and limestone quarries, with a crushing plant, near the reduction works.

The Mt. Lyell mine was discovered 1883, and the gossan was worked in a small way, as a gold mine, until taken over by the predecessor of the present company, in 1892. The North Lyell mine was developed in 1897

Owing to the extraction of ore mainly by tunnel and from quarries, the power plant at the mine is small, having only 300 indicated horse power.

The main power plant, at the smelter, transmits power electrically to the mine. The plant has a steaming capacity of 2,700 h. p., of which 1,200 h. p., is transformed into electricity, the plant including two Brown Boveri Parsons steam turbines, direct-connected to 400-kw. electric generators, replacing a smaller electric installation. A complete electric light system is maintained. Fuel is mainly cordwood, costing 8s. to 11s. per long ton, with a little soft coal costing 27s. per ton, and coke costing 30s. per ton. Yearly consumption of fuel is 67,500 tons of firewood, 42,200 cords of cordwood, 2,500 tons of bituminous coal and 10,000 tons of coke. The company owns a coking plant, at Port Kembla, New South Wales, this having 62 funnel-shaped ovens, doing a general commercial business, in addition to supplying the company's requirements.

The smelting plant is at Queenstown, on the Queen river, 1¼ miles from the mines, receiving ore by aerial tramway and counterbalance inclines surmounting the intervening hills, the aerial tramway being of 1,500 long tons daily capacity. The smelter is in two separate sections, smelter No. 1 having five water-jacket blast-furnaces, 40x168″ at the tuyeres, while No. 2 smelter has six 42x127″ water-jacket blast-furnaces, 20′ in height, over all, all furnaces having cast-iron water-jackets. The capacity of the large furnaces in No. 2 plant is about 350 tons daily, 4 furnaces being in blast regularly. The furnaces use a 3-lb. blast, supplied by nine No. 8 Root blowers and three No. 7 Root blowers, each driven by a 12x22x18″ direct-connected compound condensing vertical engine. Blast is heated by 8 hot-blast stoves, of the hanging U-pipe type. Pyritic smelting is employed for the first fusion, which gives a 15% matte, showing a concentration of six into one, with slags carrying circa 46% iron and 38% silica, and only 0.3% copper. The low-grade first-fusion matte is blown up, without previous calcining, in a small hot-blast furnace, using only a 5% coke charge, the consumption of coke averaging only 1% for the entire metal-bearing material treated. The 75-ton converter plant has two remelting furnaces, 6 stands and fourteen 60x96″ shells of Stalmann type, blast being furnished by two 16x24x30″ compound condensing air-compressors. Product is blister copper averaging 98.83% copper, 100 oz. silver and 3.21 oz. gold per long ton. The smelting plant also treats custom ores. The power plant at the smelter has twelve 125-h. p. Babcock & Wilcox boilers and 16 multitubular boilers, with a Green fuel economizer, induced draft, and superheaters, the joint use of which effects a saving of 31% in fuel costs.

The 250-ton North Lyell smelter, 28 miles from the mine, is 75x210′ in size, with four 16x32′ reverberatory furnaces, 4 blast furnaces and a converter plant. The North Lyell works also have a 69x72′ sampling mill, 41x66′ boiler-house with three 250-h. p. Stirling water-tube boilers, and a 60x100′ power-house with 200-kw. generators and cross-compound blowers. This plant is idle, and likely to remain out of commission permanently. A little cement copper is secured by leaching the mine water.

The company has two private railroad systems, of 31 and 38 miles, respectively, also a 24″ gauge line, with 6 locomotives, connecting the mines, flux quarries, smelters, warehouses and yards. The 31-mile line of 42″ gauge

runs from the smelter at Queenstown to the seaport of Strahan, with extensive wharves on Macquarie Harbor, connecting at the latter point with the Strahan-Zeehan government line, giving rail connections with all parts of the colony. The Queenstown-Strahan line traverses an exceedingly difficult country. 4½ miles of this line having gradients of 1 in 20 and 1 in 16, employing 4 special Abt type locomotives and centre-rack railway, in addition to ordinary adhesion engines. The company's private lines have 238 cars, and do a good general business, in addition to handling the company's traffic.

Miscellaneous enterprises include a complete machine shop, iron foundry, brass foundry, brickyard and three sawmills.

A chemical and fertilizer plant was completed, 1905, at Yarraville, a suburb of Melbourne, Australia. The works include an acid plant, making sulphuric acid from low-grade cupriferous pyrites from the Mt. Lyell mine. Guano rock is secured from Ocean Island, in the Pacific, and the product is superphosphates of the highest grade, for which there is a large demand in the Australian commonwealth.

The cost-sheet of the company makes an excellent showing. Cost of mining, including ores secured open-cast and underground, averages 5s. per ton, a decrease of about 6d. per ton from 1904, ore secured by quarrying costing approximately one-third as much as underground ore from the North Mt. Lyell. Smelting costs, including ore transportation, are 6s. 5d. per long ton, giving total average mining and smelting costs of only 11s. 5d. per long ton, a decrease of 2s. 2d. from the already low costs of 1904. These costs spell efficiency, and not only reflect credit upon Mr. Sticht, as the responsible manager, but indicate the existence of a well-organized and thoroughly efficient and loyal staff.

Production, 1904, was 18,513,600 lbs. fine copper, 816,643 oz. silver and 23,392 oz. gold, and for 1905 was 18,592,000 lbs. fine copper, with presumably about the same gold and silver values as in the preceding year. The Mt. Lyell has not been an easy property to handle, presenting a series of financial, mining and metellurgical problems, all of which have been solved satisfactorily. There are no dark corners in the company's office, mines, or works, and the shareholders may congratulate themselves upon possessing interests in a good mine, well managed.

MOUNT LYELL NORTH CO. **TASMANIA.**

Offices: 153, Leadenhall St., London, E. C., Eng. Moribund.

MOUNT LYELL PROPRIETARY MINES, LTD. **TASMANIA.**

Voluntarily wound up, June, 1901.

MOUNT LYELL SOUTH CO. **TASMANIA.**

Offices: 153, Leadenhall St., London, E. C., Eng. A Siamese twin of the Mt. Lyell North, and also moribund.

MOUNT LYELL TASMAN COMSTOCK GOLD, SILVER, LEAD & COPPER MINING CO., LTD. **TASMANIA.**

Offices: Launceston, Tasmania. Mine office: Mt. Lyell, Montagu Co., Tasmania. C. H. F. Shern, agent; F. H. Mitchell, mine manager. Idle.

MOUNT MOLLOY MINE. **AUSTRALIA.**

Mine office: Herberton, Queensland, Australia. Lands are circa 20 miles from the coast. Mine has been worked intermittently, under lease, for some years, largest production, 1902, being 1,200 tons of ore, of 20% to 25% copper tenor. Mine is 230′ deep, showing at the bottom a 17′ vein carrying a 5′ pay-streak of high-grade sulphide ore, and about 12′ feet of cupriferous iron pyrites. Property is considered promising, if given adequate development and equipment.

MOUNT MORGAN COPPER CO. **AUSTRALIA.**

Reorganized as Moonmera Copper Mining Co., Ltd.

MOUNT MORGAN GOLD MINING CO., LTD. **AUSTRALIA.**

Offices: 9, Gracechurch St., London, E. C., Eng., and 118, Pitt St., Sydney, Australia. Mine office: Rockhampton, Queensland, Australia. R. S. Archer, Australian chairman; W. K. D'Arcy, London chairman; J. Jenkins, London secretary; H. Woodd, Australian secretary; Capt. G. A. Richard, general manager; H. P. Seale, mine manager. Organized October 1, 1886, under laws of Queensland, with capitalization £1,000,000, shares £1 par. Has paid dividends annually since organization. Lands, 640 acres freehold, also 80 acres leasehold and 90 acres perpetual leasehold. This mine has been, for 20 years, one of the greatest gold producers of the world, but has shown declining values and decreasing output for several years past, due mainly to increased depth, but partially, perhaps, to the mistaken policy, followed in the past, of gouging out the richest ore.

Developments at depth, and extensive tests by diamond drill borings prove the immense ore body of the mine to become base at depth, and to carry greatly increased copper values, coincident with decreased gold values, hence arrangements have been made for the production of copper upon a large scale. Ore reserves of May, 1905, were estimated, conservatively, at 1,665,000 long tons blocked out, with 1,135,000 tons additional, assumed as reasonably certain to exist, ore being about equally divided between first-grade ore, averaging 3.5% copper and 8 dwts. gold per long ton, and second-grade ore, averaging 3% copper and 2.5 dwts. gold per long ton.

The new reduction plant for treating copper ores, being built at an estimated cost of £220,000, with an estimated capacity of 400 tons daily, should be in operation during 1906. Production of copper, secured as a by-product, has averaged 250,000 lbs. annually, for some years past, and amounted o 257,600 lbs. fine copper, for the fiscal year ending May 31, 1905. Assuming an average extraction of 2.5% copper, from an average of 10,000 long tons of ore monthly, which assumptions seems fully warranted by the extensive tests, the size of the new plant under construction, and the financial strength of the company, the output of copper of the Mount Morgan, for the year 1907, should be circa 6,750,000 pounds, and perhaps larger. In any case the Mount Morgan will become, during 1907, an important producer of copper, ranking third among Australian mines in output, with a prospect of taking even higher place, eventually.

MOUNT PERRY COPPER & REID'S CREEK GOLD MINES & SMELTING CO., LTD. **AUSTRALIA.**

Voluntarily wound up. June, 1902.

MOUNT PITTON MINE. **AUSTRALIA.**

Mine office: Mt. Pitton, South Australia. T. W. Styles, manager. Has steam power.

MOUNT PLEASANT MINE. **AUSTRALIA.**

Mine office: Cobar, Robinson Co., N. S. W., Australia. Is a small producer, working pockets of chalcocite, chalcopyrite and carbonates, ores being sent to the Cobar smelter for reduction.

MOUNT READ MINING CO., LTD. **TASMANIA.**

Offices Worcester House, Walbrook, London, E. C., England, and Cooks's Chambers, Elizabeth St., Hobart, Tasmania. H. G. Campion, chairman; N. M. Ogle, secretary in London; J. Hickson, secretary in Tasmania; Stafford Bird, manager. Organized Nov. 4, 1901, with capitalization £150,000, shares £1 par. Lands, 80 acres, carrying gold, silver, lead and zinc ores, assaying about 0.5% copper, also 121 acres mill and smelter sites, carrying water-rights. Development is by tunnel, with considerable ore developed, but no feasible process of treatment has been devised, the ores being very difficult of reduction and separation.

MOUNT ROSE MINE. **AUSTRALIA.**

Mine office: Wallaroo, South Australia. J. Renfrey, manager. Has steam power and employed about 20 men, at last accounts.

MOUNT ROYAL MINE. **AUSTRALIA.**

Mine office: Dandaloo, New South Wales, Australia. Property is circa 20 miles west of Dandaloo, with about 500′ of development, showing a considerable body of oxide and carbonate ores and chalcocite, assaying up to 30% and 40% copper.

MOUNT ST. HELENS CONSOLIDATED MINING CO. **WASHINGTON.**

Office: 606 Marquam Bldg., Portland, Ore. Mine office: Spirit Lake, Skamania Co., Wash. Employs 10 to 60 men. Thos. Prince, president; Chas. H. Marsh, secretary; Dr. Henry Waldo Coe, treasurer and managing director; Andrew Olson, superintendent. Organized 1902, under laws of Oregon, with capitalization $1,800,000, shares $1 par.

Lands, 106 claims, partly patented, area 2,100 acres, also a 40-acre millsite, estimated to carry 100,000,000′ of standing timber, in the St. Helens district, circa 50 miles from Portland, on the north fork of the Toutle river and on the shores of Spirit Lake. Lands include former holdings of the Sweden Copper Co., Cascadia Mining & Development Co., Calumet Copper Mining Co., Bronze Monarch Mining Co. and Cascade Copper Mining Co., giving a tract practically a parallelogram of 1½ miles width by 5 miles length. In addition to copper mines, the tract contains a granite quarry, sundry gold veins, ochre beds and a deposit of pumice stone. Country rocks are syenite, diorite and slate, carrying sundry fissures veins and contact veins between diorite and syenite. The property shows numerous veins, of which about 20 have been more or less developed, these ranging 5′ to 100′ in width, showing mainly

sulphide ores, including chalcocite, bornite and chalcopyrite, giving assays of 2% to 25% copper, occasional small lead values, 2 oz. to 50 oz. silver and $1 to $40 gold per ton, the usual oxidized ores being absent. Development is almost exclusively by tunnels, there being but one shaft, and that of only 50′ depth. The main tunnels are 250′, 400′, 600′ and 2,300′ in length, with total underground openings of 5,500′, estimated to show 125,000 tons of medium and high grade ore, with low grade ore of much greater tonnage.

The Sweden-Norway-Denmark group carries a 30′ to 40′ vein, between diorite and syneite, with mineralization mainly on the footwall, showing frequent chutes of rich ore averaging about 9% copper, 6 oz. silver and $3.25 gold per ton.

The Polar Star mine is said to show 2′ to 5′ of ore assaying 10% to 30% copper, 8 oz. to 70 oz. silver and $3 to $11 gold per ton.

The Minnie Lee group, 4 miles from the Polar Star, has about 500′ of workings, showing auriferous and argentiferous copper ore of concentrating grade.

The Earl group shows an immense gossan outcrop, carrying small gold values, with occasional bunches of high-grade copper ore, the gossan overlying a breccia.

The Bronze Monarch group, opened by a 300′ tunnel, adjoins the Sweden group, and has produced circa 1,000 tons of sulphide ore, carrying good values in copper, silver and gold.

The Index mine, circa 2½ miles from the main group, shows a vein of 44′ estimated average width, carrying ore of only 1.5% copper tenor, with about 8 oz. silver and $4 gold per ton.

Equipment includes an 80-h. p. Pelton water-wheel, 6-drill Sullivan air-compressor, 3 power drills, a sawmill and about 25 shops and cabins, at the various camps. Surveys have been made for a loop railroad line of 140 miles, running from Portland around Mount St. Helens and return. Company plans further development during 1906. Management is considered good, and property is favorably regarded.

MOUNT SHASTA GOLD MINES CORPORATION. CALIFORNIA.

An unsavory concern, succeeded, 1904, by Phoenix Gold Mining Co.

MOUNTS SICKER & BRENTON MINES, LTD. BRITISH COLUMBIA.

Mine office: Mount Sicker, Vancouver Island, B. C. W. A. Dier, managing director and superintendent. Lands, 9 claims, area 352 acres, 49 miles north of Victoria, in two groups, known as the Copper Canyon group of 5 claims, on Mount Sicker, and a group of 4 claims on Mount Brenton. Property is in the same geological horizon as the Tyee and Lenora mines, and carries a continuation of the schistose ore formation of those mines. A two-compartment shaft, sunk 144′, at an angle of 76°, shows a little good ore in the bottom, values apparently improving with depth. Considerable development work, done at different times, on various claims, has given encouragement, but the company has not yet secured a workable ore body. Management is said to plan the installation of a larger power plant, tram and concentrator.

MOUNT STANLEY MINING CO. ARIZONA.

Letter returned unclaimed from former mine office, Globe Gila Co.,

Ariz. Organized 1905, with capitalization $1,000,000, shares $1 par, to operate sundry claims lying southwest of Globe.

MOUNT STERLING MINE. **CALIFORNIA.**

Owned by Kneiper & Ashbrook. Lands are in Section 10, T. 12 S., R. 23 E., Fresno county, California. Idle.

MOUNT THECKLA MINE. **AUSTRALIA.**

Absorbed by Kangaroo Hills Mining & Smelting Co.

MOUNT UNION CONSOLIDATED MINING CO. **ARIZONA.**

Office: Germania Bldg., St. Paul, Minn. Mine office: Prescott, Yavapai Co., Ariz. R. H. Green, president; W. H. Fagley, vice-president; H. M. Temple, secretary; J. E. Whalen, general manager. Organized 1904, under laws of Arizona, with capitalization $3,600,000, shares $1 par, as successor of Mount Union Mining Co., and Arizona-Michigan Mining Co. Lands, 19 claims, in Cook Cañon, Hassayampa district, on the southwestern slope of Mount Union, Senator range, Bradshaw Mountains, circa 14 miles south of Prescott. The Arizona-Michigan mine, 9 claims, having a 175′ shaft, with circa 1,000′ of workings, shows a vein of 3′ to 6′ width, with a 12″ paystreak of argentiferous and auriferous copper and galena, of high grade. Mine also has a 460′ shaft and a small mill. Management plans replacing steam by electric power, and shipping concentrates to the Humboldt smelter.

MOUNT UNION MINING CO. **ARIZONA.**

Merged, 1904, in Mount Union Consolidated Mining Co.

MOUNT WASHINGTON COPPER CO. **MARYLAND.**

Dead. Property sold under foreclosure, March, 1903.

MOUNT WHIPPLE MINING CO. **CALIFORNIA.**

Said to have mining property in vicinity of Empire Flats, on the Colorado river, near the Bill Williams Fork river.

MOUNT ZIRKEL COPPER MINING CO. **COLORADO.**

Office: 240 La Salle St., Chicago, Ills. Mine office: Pearl, Larimer Co., Colo. Wm. A. McGuire, president; E. B. Boisot, secretary and treasurer. Organized 1901, under laws of Washington, with capitalization $1,000,000, shares $1 par. Lands, 7 claims, area 60 acres, also a 5-acre millsite, in the Big Horn district, showing a 75′ fissure vein, claimed by company to average 20% copper, 4 oz. silver and $10 gold per ton, which is too good to be true, opened by a 250′ shaft. Has steam power. Idle for several years.

MOURGOUL RIVER COPPER CO., LTD. **RUSSIA.**

Offices: 3, Princes St., London, E. C., Eng. E. Fairweather, secretary. Capitalization, £500,000. Was organized to take over sundry copper and silver-lead mines, in the Mourgoul division of the Artoin district of the Russian Caucasus, but secretary writes, Feb. 25, 1905, that company had not yet acquired its property. Apparently abortive.

SOCIÉTÉ ANONYME DE MOUZAÏA. **ALGERIA.**

Offices: 5, Rue St. Vincent-de-Paul, Paris, Xe., France. Mine office: Campdes Chenes, par Blida, department d'Alger, Algeria. E. Raschlé, president; R. Lava, secretary; M. Duvialard, general manager. Organized 1891, with capitalization 350,000 fr. Lands, 5,362 hectares, showing 6 fissure veins,

in schists, carrying chalcopyrite, and 10 contact veins carrying antimonial gray copper, veins ranging from 2cm. to 1m. wide and averaging 4% to 5% copper, and from nothing to 27 oz. silver per ton. Mine is opened by a 17m. shaft and 7 tunnels of 39m. to 63m. length, in chalcopyrite, and by 12 tunnels, four longest 220m., 240m., 255m. and 265m., in gray copper ore. Mine is served by the West Algerian railroad, 2km. distant. Copper properties have been idle since 1899, but the company has developed large bodies of hematite and spathic iron, estimated to contain 4,200,000 tons of ore of merchantable grade.

MOZUMI MINE. **JAPAN.**

Owned by the Mitsu Bishi Goshi-Kwaisha.

MULOCK TRACT. **MICHIGAN.**

Office: care of R. P. Mulock, owner, Colfax, Ia. John F. Dreiss, superintendent. Lands, 160 acres, being the Northwest ¼ of Section 9, Town 49 North, Range 41 West, near the Norwich mine, Ontonagon county, Michigan. Exploratory work, 1903-1905, has shown 2 amygdaloidal beds, outcropping at a distance of about 400′ apart, with average widths of circa 6′ and 15′, opened by several pits, showing copper.

MULTNOMAH MINING & MILLING CO. **WASHINGTON.**

Mine office: Nespelem, Okanogan Co., Wash. Has a tunnel showing ore, carrying good assay values in gold, silver and copper. Presumably idle.

MUNGANA (CHILLAGOE) MINING CO., LTD. **AUSTRALIA.**

Offices: 39, Queen St., Melbourne, Australia, and Palmerston House, Old Broad St., London, E. C., Eng. Mine office: Mungana, Lynd Co., Queensland, Australia. Employs 200 men. Harvey Patterson, chairman; V. J. Saddler, vice-chairman; E. J. J. Rodda, mine manager; Fred Back, superintendent; C. L. Hewitt, secretary in Melbourne; Edwin Habben, secretary in London. Organized March 1, 1901, under Companies Acts, 1863 to 1896, of Queensland, with capitalization £125,000, shares 5s. par. For fiscal year ending June 30, 1905, gross receipts were £25,662, with net profits of £5,742, as compared with net profits of £2,689 in the previous year.

Lands, 5 claims, area 271 acres, leasehold, in the Walsh district, carrying ores of copper, lead and silver. Mines are known as the Griffiths, developed by an 80′ open-cut; Calumet, opened by an 80′ shaft; Magazine, worked open-cast, and having an 83′ shaft; Dorothy, an old mine, opened by a 100′ shaft; Lady Jane, opened by an old 100′ shaft and a new 300′ three-compartment shaft, and Girofla. Principal operations are at the Lady Jane and Girofla mines. No. 3 shaft, on the Girofla, has been fully equipped, and on the 150′ level produces ore giving smelter returns of 18.3% copper, 16.3% lead and 34.5% silver per ton. The Girofla also has a large open-cut, stripped to a depth of 60′. The Lady Jane is proving very wet, at a depth of 200′. The old shaft was lost from a crush, and a third shaft has been sunk thereon. The water flow is circa 200,000 gallons daily. Mine is served by the Chillagoe to Mareeba Railway.

Production, 1903, was 720 long tons fine copper; 220 long tons in 1904, and only 90 long tons in 1905, but was 160 long tons for the first four months

of 1906. Production of lead is normally 4 to 6 times as great, in weight, as the output of copper, and silver values are nearly as great as copper and lead combined.

SUCESION JUAN MUÑOZ. **CHILE.**

Office and mine: La Serena, Coquimbo, Chile. Has steam power and a small smelter, employing circa 200 men, at last accounts.

MUNROE-THOMPSON ORE REDUCTION CO. **NOVIA SCOTIA & QUEBEC.**

Dead-beats, out of business. Fully described in Vol. IV.

MÜNSTER'SCHE GEWERKSCHAFT. **GERMANY.**

Office: Düsseldorf, Germany. Fr. Gessler, manager. Has iron and copper pyrites, worked in a small way, at last accounts.

MURRAY-ISABEL MINES CO. **COLORADO.**

Office and mines: care of Murray, Pavey & Seymour, owners, Parkdale, Fremont Co., Colo. E. M. Lamont, superintendent. Ores carry principal values in gold, silver and lead, with a little copper and zinc as by-products. Has steam power and concentrator, shipping concentrates direct to smelter. Employed about 20 men, at last accounts.

MURRAY MINE. **ONTARIO.**

In the vicinity of Sudbury, Algoma, Ont. Opened 1892, closed 1894, since idle. Principal values are in nickel, with some copper. Ore body, said to average 70′ wide and low in grade, is a massive pyrrhotite, carrying occasional nickeliferous and cupiferous iron pyrites.

MURRIN COPPER MINES, LTD. **AUSTRALIA.**

Voluntarily wound up, March 1905.

MURTEGA MINERALS CO., LTD. **PORTUGAL.**

Offices: 8, Princes St., London, E. C., Eng. Mine office: Barrancos, Provincia de Alemtejo, Portugal. J. D. Massey, chairman; H. G. Jones, secretary. Organized Dec. 8, 1900, with capitalization £80,000, shares £1 par; issued, £67,567. Lands include five old copper mines. Company endeavored to open a mine at the presumable point of intersection of 3 main veins, in the center of a hill, under a promising gossan capping, by shaft and tunnel. Idle.

MUTOOROO MINE. **AUSTRALIA.**

Office: care of J. P. Winch, Hindley St., Adelaide, South Australia. Mine office: Cockburn, New South Wales, Australia. Lands, 320 acres, leasehold, 14 miles southwest of Cockburn, showing ores in great variety, including cuprite, malachite, azurite, chrysocolla and atacamite near surface, changing in depth to chalcocite, bornite, and chalcopyrite, associated with iron pyrites. Ores occur as lenses of considerable size near the contact of intrusive rocks, and average about 6.5% copper in treatment. Property has paid small dividends. Presumably idle.

MUTUAL COPPER CO.

Office: 100 Boylston St., Boston, Mass.

MUTUAL GOLD & COPPER MINING CO **WYOMING.**

Letter returned unclaimed from former office, Rawlins, Wyo. De Forest Richards, president; L. E. Armstrong, secretary. Organized 1900, under

laws of Wyoming, with capitalization $500,000, shares $1 par. Lands, 4 claims, area 65 acres, in the Battle Lake district of Carbon county, Wyoming, showing an 8′ vein, opened by a 200′ tunnel.

MYSTIC SHRINE GOLD & COPPER MINING CO. **UTAH.**

Dead. Lands sold to Intermountain Mining & Industrial Association.

COMPAÑIA METALURGICA NACIONAL. **MEXICO.**

Mexican title of National Metallurgical Co.

COMPAÑIA MINERA LA NACIONAL. **MEXICO.**

Mine office: El Salado, San Luis Potosí, Mex. Miguel Ferrara, president; José Marie Parga, manager. Company operates El Saltillito mines, producing silver, gold and copper. Has steam power and employed 150 to 200 men, at last accounts.

NACO SMELTING & REFINING CO. **ARIZONA.**

Office: 522 Bradbury Bldg., Los Angeles, Cal. Works office: Naco, Cochise Co., Ariz. Robert Mitchell, president and treasurer; Robert E. Morrison, vice-president; Chas. B. Lewis, secretary; preceding officers, Henry J. Stevens and N. M. Edwards, directors. Organized under laws of Arizona, with capitalization $500,000, shares $10 par. Lands, 53 acres, just east of the Naco townsite, reached by the El Paso & Southwestern Railway, on which it was planned, early in 1906, to build a 250-ton custom smelter, costing circa $75,000. Smelter will have a 250-ton Mitchell economic hot-blast furnace, similar to those at the Greene Consolidated, Copper Queen and United Verde mines. Company will be closely affiliated with the South Cananea Copper Co., of which Robert Mitchell is president. Water will be secured from artesian wells, and the smelter will have a 50-kw. electric light plant, 5-ton ice plant, etc., employing circa 150 men.

NACOZARA MINING & REDUCTION CO. **MEXICO.**

Letter returned unclaimed from former office, Los Angeles, Cal. Fred Ohlmeyer, president; J. Irving McKenna, secretary. Organized July 1902, to take over a copper-gold property, 7 miles from Moctezuma, Sonora. Presumably idle.

NAFVERBERGS KOPPARVERK. **SWEDEN.**

A small property, in Kopparbergs Län, Sweden. Production, 1902, was 361,800 kilograms of low-grade copper matte.

NAGAMATSU MINE. **JAPAN.**

Mine office: Okura-mura, Mogami-gori, Uzen, Japan. Ore is chalcopyrite, associated with iron pyrites and a little sphalerite, in quartz gangue. Has many veins, largest ranging from 6″ to 2′ in width. Production, 1904, was 620,000 lbs. fine copper.

NAHMINT MINING CO. **BRITISH COLUMBIA.**

Mine office: Alberni, Vancouver Island, B. C. Property is the Hayes mine, having about one mile of underground openings, and a 1-mile aerial tram. Work was suspended in 1902, when mine was said to be nearly exhausted, but later developments, at adjoining properties, were of such a nature that work was resumed in 1904. Presumably idle again.

COMPAÑIA MINERA DE NALTAGUA. **CHILE.**

Property is the Naltagua mine, opened 1898, in the department of Melapilla, Chile.

NAMAQUA COPPER CO., LTD. **CAPE COLONY.**

Offices: 3, Fenchurch, St., London, E. C., Eng. Mine office: Concordia, Little Namaqualand, Cape Colony. Fredk. J. Mirrielees, manager; Francis Phillips, superintendent; A. W. Outram, secretary. Organized April 23, 1888, as reconstruction of Namaqua United Copper Co., Ltd., with capitalization £200,000, shares £2 par; issued, £188,662. Has paid annual dividends of 7.5% to 40%. since organization, excepting 1891 to 1894 and 1901-1902. Paid 5% in 1903, 7.5% in 1904 and 7.5% in 1905. Lands, 680 acres leasehold, held on royalty of 2s. 6d. per ton of ore produced. Mines are the Tweetfontein, with 7 shafts; Wheal Julia, with 3 shafts; Flat and New East Centre, with one shaft each; Jubilee, Henderson and Prospect, with 2 shafts each. Has concentrating plants at the Flat and New East Centre mines, where ore is dressed up to 25% to 30% in tenor, for shipment to British smelters, via Port Nolloth. Ore is high-grade chalcopyrite, occurring with intrusive greenstone, traversing granite. Production was 12,088 tons (of 21 cwts.) ore in 1904. Production, 1905, was 5,276,712 lbs. fine copper. Property has considerable ore reserves, and is managed conservatively and ably, having a surplus fund of about £40,000, invested in British consols, and has returned profits of double its capital since organization.

NAMAQUA VENTURE SYNDICATE. **CAPE COLONY.**

Mine office: Wittwater, Little Namaqualand, Cape Colony. Was developing a new copper mine, said to be of some promise, circa 1904.

NANAIMO JUBILEE MINING & DEVELOPMENT CO., LTD. **BRITISH COLUMBIA.**

Lands are the Delphi group of 7 claims and the Green Mountain group of 8 claims, in the Dunsmuir district of British Columbia, circa 18 miles from the Esquimault & Nanaimo railway. Property, though slightly developed, is considered promising.

NANCOT COPPER CO. **NEW MEXICO.**

Office: care of H. S. Clark, president, Southboro, Mass. Mine office: Belen, Valencia Co., N. M. Organized Oct. 1902, under laws of New Mexico, with capitalization $1,000,000, shares $1 par. Bonds, $250,000 authorized, running 5 years, at 6%. Company is giving a bonus of $2 in stock with each dollar of bonds sold. Lands, 26 claims, in the Manzana Mountains, near Belen, fairly timbered and watered, and near a projected branch line of the Santa Fé railway. Mine has a 2-compartment shaft, and at last accounts was shipping a few carloads of ore running 15% to 20% copper.

NANCY HANKS MINE. **MONTANA.**

Mine office: Garnet, Granite Co., Mont. Title is in dispute. Ores carry gold, silver and copper. Has steam power. Idle.

NANTLLE VALE COPPER MINING CO., LTD. **WALES.**

Offices: 11, Dale St., Liverpool, Eng. Mine office: Llanllyfin, Carnarvon, Wales. O. A. Harling, chairman; W. H. Hill, secretary. Organized

Sept. 9, 1900, with capitalization £5,000, shares £1 par. Issued, £4,007. Debentures, £8,500, protected by first, second and fourth mortgages. Cannot be learned that company ever has done any mining.

NAPA COUNTY COPPER MINING CO. **CALIFORNIA.**

Letter returned unclaimed from former office, 1206 Market St., San Francisco, Cal. Owen Wade, president; F. J. Taylor, secretary and treasurer. Organized August 22, 1902. Lands, 13 miles south of Middletown, Napa county, California, are developed by a 400′ tunnel.

NAPOLEON & MAGHERA COPPER MINING & REDUCTION CO. **UTAH.**

Office: Lock Box 537, Cedar Rapids, Iowa. Operating office: Lock Box 517, Ogden, Utah. Mine office: Utah Hot Springs, Box Elder Co., Utah. Employs 10 men. Don McGuire, president and general manager; J. H. Kincaid, vice-president; Dr. James W. Dalbey, secretary and treasurer; Daniel Convery, superintendent; preceding officers, Lee Kincaid and John Logan, directors. Organized February, 1904, under laws of Utah, with capitalization $1,000,000, shares $1 par. Annual meeting, third Wednesday in June. Lands, 12 claims, area 240 acres, patents pending, also a 10-acre millsite, in the Sierra Madre district, with granite country rock carrying a continuous outcrop showing mineralization for a distance of 13,800′ on the company's lands. Mineralization on two ore bodies ranges 16′ to 600′ width, showing mainly bornite and chalcopyrite, with occasional chalcocite and copper silicates, assaying 3% to 30% copper, 2 oz. to 10 oz. silver and $2 to $4 gold per ton, opened by tunnels of 260′ and 85′, with a quarter mile of workings, estimated to show 200,000 tons of ore, with 75,000 tons blocked out for stoping. Equipment includes small shops and mine buildings. A smelter and railroad, at Utah Hot Springs, are only 2½ miles from the mine. Company plans continuous development, installation of a 4,000′ aerial tram, and the building of a 300-ton concentrator. Property is regarded favorably.

NAPOLEON MINE. **CALIFORNIA.**

Mine office: Copperopolis, Calaveras Co., Cal. Is the oldest copper mine in California, and once was a considerable producer. Vein channel is 100′ wide and ranges from diabase to talcose schist, ore bodies occurring in lenses up to 20′ wide. Ores are principally sulphide, with a fair sprinkling of carbonates and oxides. Old shaft, 325′. A new shaft has been sunk to the westward. Considerable copper has been produced, during past few years, by leaching the old dumps. Work was resumed, after a year's idleness, early in 1906.

NAPOLEON MINE. **WASHINGTON.**

Mine office: Boyds, Ferry Co., Wash. Harry Johns, superintendent. Is under bond to the British Columbia Copper Co., and in 1905 was shipping 20 tons daily, of copper ore with excess of iron and sulphur, to the Greenwood smelter.

NASHVILLE MINE. **COLORADO.**

Letter returned unclaimed from former mine office, Idaho Springs, Colo.

NATIONAL CAPITAL COPPER CO. **MEXICO.**

Office: 1901 Seventh St., N. W., Washington, D. C. Mine office: Cosna,

Michoacán, Mex. Henry M. Baker, president and treasurer; Francis M. Criswell, secretary; Samuel W. Scott, general manager. Organized April 23, 1902, under laws of Virginia, with capitalization $150,000, shares $1 par. Lands, 550 pertenencias, area circa 1,375 acres, in the Tacambara district, showing 6 contact veins between granite and limestone, carrying native copper and argentiferous and auriferous oxide, carbonate and sulphide ores. Two veins are being developed by tunnels, the Confianza vein being said to be 70′ wide. Nearest railway is the Mexican National, 45 miles distant. Property has ample water available, and is well timbered.

NATIONAL COPPER & GOLD MINING CO. ARIZONA.

Office: care of Gates M. Fowler, general manager, Phoenix, Ariz. Organized 1904, under laws of Arizona. Lands are the Rogers Springs group, in the Cave Creek district, circa 30 miles north of Phoenix, Maricopa county, Arizona, held on $60,000 bond and lease from W. E. Marlar.

NATIONAL COPPER MINING CO. UTAH.

Office: 400 D. F. Walker Bldg., Salt Lake City, Utah. F. E. Smith, president; W. H. Tibbals, vice-president; C. E. Peyton, secretary and treasurer. Capitalization $100,000, shares 10 cents par. Lands, circa 115 acres, in the La Sal Mountains, Sonoma district, Grand county, Utah. Ore assaying 9.5% copper, with traces of gold and 17.5 oz. silver per ton, has been taken from a fissure vein traversing sandstone. Idle.

NATIONAL COPPER MINING CO. WYOMING.

Office: Douglas, Carbon Co., Wyo. Frank Tinkham, president; G. W. Johnson, secretary; H. C. Paul, general manager. Organized July, 1902, with capitalization $250,000. Lands, sundry claims, near Guthrie, Wyoming. Idle.

NATIONAL COPPER ORE CO. VIRGINIA.

Mine office: Garrisonville, Stafford Co., Va. Lands carry deposits of cupriferous iron pyrites.

NATIONAL GOLD & COPPER CO. ARIZONA.

Office: care of Ben Blanchard, manager, Prescott, Ariz. Lands are in Yuma county, near the Bill Williams Fork river, slightly developed by several shallow shafts.

NATIONAL GOLD & SILVER MINING CO. NEW MEXICO.

Mine office: Stein's Pass, Grant Co., N. M. B. L. Berkey, superintendent, at last accounts. Has steam power and a 50-ton concentrator.

NATIONAL METAL CO. MEXICO.

Office: 120 Liberty St., New York. Works office: Guadalajara, Jalisco, Mexico, and Ameca, Jalisco, Mexico. H. B. Lewis, general manager. Has sampling mills at Ameca and Guadalajara, and a new plant building at Nonoalco, near the City of Mexico, under the superintendency of D. C. Doney, will be the first purely lead refinery, on a modern scale, in the republic. The Nonoalco plant will have 8 furnaces and an electrolytic plant, exclusively for lead.

NATIONAL METALLURGICAL COMPANY. MEXICO.

Offices: 505 Equitable Bldg., Denver, Colo., and 1503 Arrott, Bldg.,

Pittsburg, Pa. Mine and works office: Matehuala, San Luis Potosí, Mexico. H. N. Nichols, president and general manager; Chas. H. Job, vice-president; John S. Gibbons, secretary; J. H. McConnell, treasurer; Nat. Turner, general superintendent; Albert L. Waters, metallurgist; A. P. Callender, general agent; Chas. L. Williams, superintendent; W. B. Watson, assistant superintendent; E. O. Dane, engineer; Grattan Foley, cashier. Organized under laws of Colorado, with capitalization $1,000,000, shares $25 par. Bonds, $500,000, at 6%.

Lands, 51 claims, area 1,200 acres, also a 125-acre smelter-site and 75 acres miscellaneous lands, the mine tract including La Cobriza and adjoining mines. Country rock is limestone, altered by intrusive granite-porphyry, ore bodies occurring as lenses and contact veins in an altered zone of garnetic wollastonite, ore bodies having a generally north and south strike, with a western dip of circa 45°. The company's lands carry 26 known ore bodies, of which 7 are more or less developed, these, ranging from 3′ to 130′ width and from 200′ to 1,200′ length, having been opened to a depth of 200′ only. Mines have 6 shafts, including the 100′ Aurora shaft, and 120′ El Carmen shaft, and 20 tunnels, of 2,280′ aggregate length, estimated to put 364,000 tons of ore in sight, with 171,400 tons blocked out for stoping. Ores include malachite, bornite and chalcopyrite, carrying estimated values of 4.5% copper, 6 oz. silver and $2 gold per ton. Company has added to La Cobriza the Monte Cristo, Alpha and Beta mines. The mine has 4 stone buildings, for various uses.

The company has a smelting franchise and sundry other government concessions, and has arranged to secure a plentiful supply of water from a distance of 18 miles, and will furnish water to the city of Matehuala, in addition to supplying the smelter.

The smelter, 7 miles from the mine, has a 200-ton copper matting furnace, turning out matte with an average tenor of 50% copper, 120 oz. silver and 0.5 oz. gold per ton. The smelter was blown in, circa January 1, 1906, and does a general custom business, as well as smelting La Cobriza ores. Management plans erecting a steel furnace building, adding an electric power plant, and increasing the smelting capacity to 500 tons daily, during 1906.

The promoters of the company enjoy a good local standing, and the mines and plant seem to be operated along sound lines, under competent management, but the estimates of prospective profits, put out by the company while placing stock, are entirely too high.

NATIONAL MINING CO. **BRITISH COLUMBIA & CALIFORNIA.**

Office: Tacoma, Wash. Mine office: Waldo, Ore. S. J. Pritchard, president; Geo. P. Larsen, secretary; John Sanger, superintendent. Capitalization $10,000,000. Property is the Sanger group of 35 claims, area 700 acres, in Del Norte county, California, a few miles south of Waldo, also sundry mining claims in British Columbia. Also has oil lands in western Washington and several mining claims in the lower Arrow Lake district, British Columbia. The Sanger ores give good assay values in copper and gold, and company is said to plan construction of a smelter. Company

may be doing a legitimate business, but its advertising is of such an exaggerated nature, and capitalization is so excessive, that no conservative investor would care to have anything to do with the property.

NATIONAL MINING CO. **MICHIGAN.**

Office: 15 Congress St., Boston, Mass. Mine office: Rockland, Ontonagon Co., Mich. John C. Watson, president; Daniel L. Demmon, secretary and treasurer. Organized 1878, with capitalization $2,500,000; issued, $1,875,000, Lands adjoin the old Minnesota mine, now owned by the Michigan Copper Mining Co. Has produced nearly 6,000 tons of copper, and has paid dividends of $320,000. Idle since 1893. Fully described in Vol. II.

NATIONAL MINING EXPLORATION CO. **ARIZONA.**

Office: 1012–60 State St., Boston, Mass. W. H. Mitchell, president; Frank A. Woodward, secretary and treasurer; preceding officers, Wilbert Morgrage, A. P. Cheney, Chas. M. Bruce, H. H. Hazeltine and Kendric P. Crawford, directors; M. J. Galpin, superintendent; J. D. Coplen, consulting engineer. Organized November, 1905, under laws of Maine, with capitalization $1,500,000, shares $1 par. Lands, 7 claims, area circa 125 acres, lying 1½ miles frome Globe, Gila county, Arizona, with a good wagon road between, also claims on the Gila river, lying 7 miles west of Kelvin. Latter property shows 3 veins, in a mineralized zone of circa 500′ width, opened by an old shaft of 130′, which the present company plans deepening to 700′. Lands were held formerly by the Iron Cap Mining Co. Company plans vigorous development.

NATIONAL MINING & MILLING CO. **COLORADO & WYOMING.**

Office: 1101 Fisher Bldg., Chicago, Ills. Mine office: Pearl, Larimer Co., Colo. O. S. Richardson, president; Ford H. Rogers, vice-president; J. J. Tufts, treasurer; C. E. Knapp, secretary and general manager; Harold Wilson, superintendent. Company controls the Chatterton Mining Co., Rogers Mining Co., Knapp Mining Co. and Pearl Smelting Co.

The Chatterton Mining Co. owns the Kurtz-Chatterton mine, 7 claims, area 125 acres, in the Upper Platte district of Carbon county, Wyoming, opened by shafts of 30′, 35′ and 38′ and a 1,750′ crosscut tunnel, showing 7 veins of low-grade sulphide ore traversing granite, the widest vein, 17′, giving average assays of about 5% copper, with a trace of gold, ore being well adapted to concentration. Equipment includes a 5-stamp mill and 50-ton concentrator. Idle at last accounts.

The lands of the Rogers Mining Co. are 6 claims, area 110 acres, adjoining the Kurtz-Chatterton, opened by a 135′ shaft and a crosscut tunnel of 1,100′, showing low-grade ores, chiefly malachite, azurite and chalcopyrite.

The Knapp Mining Co. owns 9 claims, area 80 acres, near Pearl, Larimer county, Colorado. Two fissure veins in gneiss and diorite, opened by shafts of 65′ and 85′, show chalcopyrite and occasional bornite. The mine has a 25-h. p. steam hoist.

The Pearl Smelting Co. has a 175-ton blast furnace, with 175-h. p.,

steam plant, planned to do custom smelting as well as treating the ores of its allied properties. The smelter was uncompleted at last accounts.

NATIONAL RADIUM & COPPER CO. **COLORADO.**

Office and works: 828 Equitable Bldg., Denver, Colo. Is a reorganization, circa 1905, of the Union Ore Extraction & Reduction Co. Works of of the old company, at Thirty-first and Wewatta streets, Denver, used the Gardiner leaching and precipitating process, the mill having an estimated daily capacity of 300 tons, with estimated leaching and precipitating capacity of 75 tons daily.

NATIONAL SMELTING CO. **MEXICO.**

Office: 2030 Land Title Bldg., Philadelphia, Pa. Mine office: Chalchihuites, Zacatecas, Mexico. Employs 300 men. L. H. Taylor, Jr., president; Richard G. Park, vice-president; William McKnight, secretary; John J. Little, treasurer; Theo. Montgomery, general manager; preceding officers, John P. Whitney, John P. Logan, Clarkson Clothier and Adolph Trauwitz, directors; John M. Bell, mine superintendent; Albert R. Wores, smelter superintendent; Henry Carnaghan, mill superintendent; Colin Timmons, engineer. Organized March 27, 1906, under laws of Maine, with capitalization $1,000,000, shares $5 par; issued, $600,000. Bonds, $150,000, at 6%. Annual meeting, second Tuesday in August. Operates in Mexico under title Cia. Benificiadora de Minerales de Chalchihuites, S. A. Lands, 192 pertenencias, area 480 acres, in 10 groups, also a 38-acre millsite, sundry water-rights and an option on 15,000 acres of timber lands, in the Chalchihuites and Sombrerete districts. Formation is mainly limestone, with frequent intrusions of eruptive rocks, ore bodies occuring as fissures in the eruptives, as pockets in the limestone, and as contact veins between limestone and eruptive rocks. Of the 10 properties, 6 are in operation, and 4 are shipping ore, the producing mines being the Anaconda, San Juan, Nungano and La Colorada, with La Esplendida and El Manto mines under development. The Anaconda shows a 36′ vein, mined open-cast, giving ores averaging 2.5% to 3% copper. The Nungano has an ore body of 6′ to 15′ width, 120′ length and 160′ depth, giving ore of 2.5% to 3% copper tenor. The other mines carry auriferous silver-lead ores exclusively, these ranging from 20% to 45% lead, 10 oz. to 50 oz. silver, and $2 to $5 gold per ton. The Nungano has shafts of 30′, 60′ and 160′ and tunnels of 250′ and 300′, and is estimated to show 100,000 tons of ore. Mines were opened in the Seventeenth Century, and until present ownership, had been worked, since circa 1850, in a small way, by local owners, with adobe smelters. The mines are operated exclusively by hand power, malacates being used.

Equipment includes a 50x60′ machine shop, 20x25′ smithy and 20x20′ carpenter shop, all of timber and adobe, with about 20 other buildings, for various uses.

The concentrator, of 60 tons daily capacity, built of timber and iron, has a 14x17″ Dodge crusher, 2 pairs of rolls, 3 New Century jigs, 2 sizers, 6 Bartlett and Standard tables, settling tanks, etc. The smelter, which also does

custom smelting, is at Chalchihuites, 1 to 12 miles from the various mines, having 7 brick stall calciners, a 10-ton reverberatory furnace and 50-ton water-jacket blast-furnace, latter working interchangeably on lead and copper ores, the copper product being a matte carrying circa 45% copper, 180 oz. silver and 2. oz. gold per ton, sent to the American Smelting & Refining Co., at Aguascalientes, for refining. Nearest railroad is the Mexican Central, 90 miles distant, but it is expected that a branch will be built from Gutierrez to Chalchihuites, circa 1908. Company plans opening mines on a larger scale and erecting a new concentrator at La Colorada mine. The smelter is to have a new 100-ton blast-furnace, roasting-furnace, refining-furnace, sampling mill and gas plant.

NATIONAL SMELTING CO. **SOUTH DAKOTA.**

Office, mine and works: Rapid City, Pennington Co., S. D. Mines ores carrying gold, silver and copper, latter being a by-product. Has a smelter, employing circa 200 men, at last accounts.

NATIONAL SMELTING & REFINING CO. **NEW MEXICO.**

Letter returned unclaimed from former works office, Lordsburg, Grant Co., N. M. Had a 50-ton smelter, built 1903, on the Aberdeen property, and held a contract to smelt ores of that moribund corporation of evil memory. Presumably dead.

NATIVE COPPER CO. **MICHIGAN.**

Office: 68 Devonshire St., Boston, Mass. M. Augustus O'Neil, president; F. W. Morandi, secretary and treasurer. Lands, 480 acres, in Keweenaw county, Michigan, being the South ½ of Section 3 and Northeast ¼ of Section 10, Town 58 North, Range 30 West. A little work was done, 1852-1855, on a fissure vein, since which time the property has been idle.

NAVERFJORD MINES. **NORWAY.**

Mine office: Naverfjord, Norway. Production, 1902, was 160 tons first-grade and 1,500 tons second-grade ore, containing metallic values equal to circa 180 metric tons fine copper.

NELSON COPPER FIELDS, LTD. **BRITISH COLUMBIA.**

Offices: 57 Moorgate St., London, E. C., Eng. Letter returned unclaimed from former mine office, Nelson, B. C. H. Shepherd Cross, chairman; C. S. Good, secretary. Capitalization, £100,000. Lands, 344 acres, on Morning Mountain. Idle since 1900.

NELSON COPPER SYNDICATE, LTD. **BRITISH COLUMBIA.**

Organized January, 1905, under laws of British Columbia, with capitalization $10,000, shares $100 par. Apparently inoperative.

GEWERKSCHAFT NEUE KIRCHE. **GERMANY.**

Mine office: Gross-Schliefensteinthal bei Goslar, Harz, Germany.

C. NEUMANN & CO. **CAPE COLONY.**

Said to own promising copper claims in Little Namaqualand, Cape Colony, South Africa.

NEVADA BELL COPPER MINING & REDUCTION CO. **NEVADA.**

Office: 850 Drexel Bldg., Philadelphia, Pa. Letter returned unclaimed from former mine office, Lovelocks, Humboldt Co., Nev. C. W. Sweitzer,

president; H. H. Barbee, vice-president; A. P. Platt, secretary and treasurer. Organized 1902, under laws of Nevada, with capitalization $5,000,000, absorbing the Nevada Copper Co. and the Bell Mare Mining & Smelting Co. Lands, circa 500 acres, with considerable development The 500′ Bell Mare tunnel was planned to be driven 1,500′, to cut the vein found in the Copper King tunnel. Ore bodies are said to be large, but of low grade, averaging about 4% copper, and occuring as replacements in a formation of andesite porphyry. Has a 60-ton smelter. Presumably idle.

NEVADA CENTRAL COPPER CO. **NEVADA.**

Office: care of Robert L. Benson, secretary, 157 Michigan Ave., Chicago, Ills. Mine office: Palisade, Eureka Co., Nev. Col. Chas. Lay, president; Geo. W. Leighton, vice-president; preceding officers, William Andrews, Jos. D. Wright, John A. Saull and Edwin L. Wilson, directors. Organized under laws of District of Columbia, with capitalization $1,000,000, shares $10 par, in $750,000 preferred non-cumulative 7% stock, and $250,000 common stock. Lands, 10 claims, area 200 acres, in the Antelope district, on the western slope of the Sulphur Mountains. Development is by a 130′ shaft, showing ores carrying claimed average values of 21.03% copper.

NEVADA CONSOLIDATED COPPER CO. **NEVADA.**

Office: 66 Broadway, New York. Mine office: Ely, White Pine Co., Nev. James Phillips, Jr., president; Homer Loring, vice-president; Geo. E. Boas, secretary and treasurer; preceding officers, M. L. Requa, S. D. Loring, W. Hinckley Smith, Chas. Hayden, C. S. Shepard and E. H. Reynolds, directors; J. Parke Channing and F. W. Bradley, consulting engineers; E. F. Gray, superintendent; Thos. W. Cox, metallurgical engineer. Capitalization $6,500,000, shares $5 par. Is controlled by the Guggenheims, through control of the American Smelting & Refining Co., through control by latter of American Smelters Securities Co., through control by latter of 51% of Cumberland-Ely Mining Co., through ownership by latter by control of stock of the Nevada Consolidated Copper Co.

Lands, circa 1,400 acres, partly patented, in the Robinson district, 6 miles west of Ely, and circa 140 miles south of Toano station, on the Southern Pacific Railway. Lands include the properties formerly held by the White Pine Copper Co., Chainman Mining & Electric Co., New York-Nevada Copper Co., and by sundry other corporations and individuals. Principal properties are the Ruth group, area circa 300 acres, and the Eureka or Copper Flat group, one mile west of the Ruth, area circa 400 acres. Company also owns the Georgetown ranch, area circa 320 acres, including valuable water-rights on Murray creek, which carries a flow of about 4,000,000 gallons daily, assuring an ample water supply for mining, milling and smelting operations.

The geology of the district is much similar to that of the Clifton and Morenci deposits in Graham county, Arizona, and is to some extent similar to that of the Bingham Canyon district of Utah, in that ore values occur largely in the country rock. The tract shows an outcrop of gray, sintery quartz, showing occasional copper carbonates. One portion of the tract

shows an extreme width of about 2,000′ of these croppings, under which, at a depth of circa 300′, are found low-grade ores in the original plutonic quartz-porphyry. The upper workings show melaconite and chalcocite, changing at water level to disseminated chalcocite and chalcopyrite, the ore being mainly chalcocite, associated with pyrite, in fine seams, and occuring disseminated as speiss through the rock-mass. Walls of the ore bodies are not well defined, the entire formation being impregnated by ore to a greater or less extent. Estimates of the amount of ore in sight vary greatly, ranging from 6,000,000 tons to 25,000,000 tons, the larger figure probably being more nearly correct. The mine-water is strongly impregnated with copper, causing trouble with the pumps.

The Ruth mine has an ore body of 50′ to 250′ width, opened for a length of 900′ and to a depth of 250′. The main shaft is 640′ deep, showing large bodies of low and medium grade copper ore, with a marked tendency toward decreasing values at depth, leading to the opinion that the shaft may have passed through the bottom limit of payable ore. Estimates of the amount of ore in sight in the Ruth mine vary from 2,400,000 tons to 6,000,000 tons. Mr. Channing estimates the Ruth to show 2,400,000 tons of ore, averaging 2.6% copper, 0.05 oz. silver and 0.02 oz. gold per ton. A 4-compartment main working shaft is being sunk on the Star Pointer claim.

The Eureka mine shows ore of somewhat lower average value than the Ruth, and is opened by 2 shafts, known as the Eureka and Star of the West. The Eureka vertical shaft is 400′ deep, bottomed in poor ore, with promising developments on the 170′ level, where a careful sampling gave average assays of 2.32% copper, 0.03 oz silver and 0.02 oz. gold per ton, with 3,200,000 tons of ore in sight. The mine is opened for a distance of circa 700′ east and west, and 800′ north and south, showing payable ore over this area. The Eureka is to be worked on the caving system, or else by steam-shovel, and, in any case, the capping will be stripped by steam-shovel. Mr. Bradley estimates 16,000,000 tons of ore in sight at the Eureka.

Surface improvements at the Ruth mine include an engine-house, boarding-house, office, stable and 6 dwellings.

An experimental mill, built 1904, at the Ruth mine, has shown a concentration of 7 into 1, giving concentrates averaging 17.5% in copper tenor. The new reduction plant, now building on a 10-acre site, will be the first 1,250-ton unit of a 2,500-ton mill. Work on the second unit will begin as soon as the first is completed and in operation. The mill will have six 6′ Huntington mills, in 2 groups, 2 heavy Blake crushers, 8 Overstrom tables and 91 vanners. Machinery equipment will include two 22x48″ Allis-Chalmers compound condensing engines, direct-connected to 800-kw. Bullock generators, and the plant will have 7 motors of 20-h. p. to 100-h. p., for various uses, electricity being used throughout the mine and smelter. The mill buildings will be of steel throughout, and the plant has been designed with great care, embodying all of the latest metallurgical features of proven value.

The smelter will have 6 McDougall 3-deck circular roasters, 18′ in diameter and 19′ 6″ high, each driven by a 20-h. p. Bullock induction motor.

Ores will be matted in reverberatories, instead of in blast-furnaces. Equipment will include a 16x32″ blower, with capacity to reduce 6,000 cu. ft. of free air per minute to circa 18 pounds pressure per sq. inch. The smelter is planned to turn out blister copper of 99% in tenor, carrying $10 in combined gold and silver values. Construction is proceeding somewhat slowly, owing to lack of rail facilities.

The Nevada Northern Railway Co., controlled by the Nevada Consolidated Copper Co., is building a line of approximately 140 miles length, from Ely to a junction with the Southern Pacific Railway at Cobre, 3 miles east of Toano. Capitalization of the railway company is $2,000,000, with $1,000,000 bonds, at 5%, and the line will cost $1,250,000 to $1,500,000, complete. The road is of standard gauge, and should be completed during the fall of 1906, after which work will be rushed on the reduction plant. The railroad will do a large general business, in addition to handling the traffic of the Nevada Consolidated Copper Co.

This property is one of altogether exceptional promise, and enjoys the benefit of a management that is both experienced and financially strong. Mr. J. Parke Channing, than whom there is no better copper authority, estimates that an investment of about $3,000,000 will be required in constructing the railway, opening mines and building a reduction plant to give the property an annual productive capacity of circa 25,000,000 pounds fine copper, which should be made, according to the same authority, for 7 cents per pound. The Nevada Consolidated may not become an important producer until 1907, and another year will be required to put the property on the basis estimated by Mr. Channing.

NEVADA CONSOLIDATED COPPER & GOLD MINING & MILLING CO. **NEVADA.**

Office: 506-31 State St., Boston, Mass. Mine office: Yerington, Lyon Co., Nev. Jas. P. Niles, president and general manager; Jas. D. Niles, treasurer. Organized under laws of Maine, with capitalization $1,000,000, shares $1 par. Lands were 16 copper claims in Lyon county and 12 gold claims in Lincoln county, Nevada, but the copper claims were lost. Finances apparently hopelessly involved.

NEVADA CONSOLIDATED SMELTING & REFINING CO. **NEVADA.**

Office: 201 Exchange Bldg., Denver Colo. Works office: Pioche, Lincoln Co., Nev. Wm. Gelder, manager. Has a 200-ton smelter and 22 miles of narrow-gauge railroad. Is closely affiliated with the Hillside Copper Co. and Bristol Copper Co. Is in debt and idle.

NEVADA COPPER CO. **NEVADA.**

Merged, 1902, in Nevada Bell Copper Mining & Reduction Co. Property was near Lovelock, Humboldt county, Nevada.

NEVADA COPPER CO. **NEVADA.**

Mine office: Sandy, Lincoln Co., Nev. N. M. McFatridge, president. Lands, 13 claims, showing an auriferous copper vein, assaying up to 32% copper and $20 gold per ton, paralleled by a silver-lead vein, showing gross assay value up to $150 per ton, opened by a 90′ shaft. A small smelter shipment,

to El Paso, gave returns of 50% copper, with gold and silver values. Company is said to have a contracted with the Goodsprings Smelting Co to treat its ores. Property is considered promising.

NEVADA DEVELOPMENT CO. **NEVADA.**

Office: 201 Walnut Place, Philadelphia, Pa. Mine office: Lovelock, Humboldt Co., Nev. Theo. H. Lowe, superintendent. Lands include the Copper Glance and adjoining claims. Idle at last accounts.

NEVADA GOLD & COPPER MINING CO. **NEVADA.**

Letter returned unclaimed from former office, San Francisco, Cal.

NEVADA QUEEN MINING CO. **NEVADA.**

Office: care of J. K. Miller, P. O. Box 1202, Colorado Springs, Colo. No particulars secured in response to requests, although company advertises a strong desire to furnish details to all inquirers.

NEVADA-UTAH MINES & SMELTERS CORPORATION. **NEVADA & UTAH.**

Office: 100 Broadway, New York. Mine offices: Bingham Canyon, Salt Lake Co., Utah, and Pioche, Lincoln Co., Nev. Col. John Weir, president; Edward F. Cragin, vice-president; Anthony H. Godbe, managing director; Morris P. Kirk, general manager; Edward F. Freudenthal, superintendent; preceding officers, Hon. A. B. Lewis, Chas. J. Hodge, A. S. McCornick, J. P. Haines and John W. Griggs, directors; C. J. Caughey, secretary; Heman Dowd, treasurer; John R. Dos Passos, general counsel; G. F. Milliken, managing engineer. Organized, 1904, under laws of Maine, with capitalization $15,000,000, shares $10 par. Debentures, authorized, $1,000,000, registered 5-year 6% gold bonds, due Dec. 1, 1909, convertible at option of holders, after Dec. 1, 1906, into common stock, at par.

Landed holdings are extensive and valuable, but just how extensive cannot be stated positively, as the holdings seem to vary. Senator Lewis, the organizer of the Nevada-Utah Mines & Smelters Corporation, has been, for about ten years past, engaged in promoting, organizing and reorganizing mining companies in Utah and Nevada. A survey of Senator Lewis's promotions, from year to year, gives a kaleidoscopic impression of organizations, reorganizations, reconstructions and re-reorganizations, with wheels within wheels, and corporations within corporations, all coming in, going out, re-entering or disappearing, in a sort of bedlam dance that seems to lack the semblance of system. Mr. Lewis seems to consider that the public has no particular right to information regarding his promotions, once the stock is placed, and presumably is so busy in organizing and reorganizing his numerous promotions, that he really has no time to answer annoying questions, or allow a glimpse of his private corporate necropolis.

The Nevada-Utah Mines & Smelters Corporation presumably is a securities-holding company, and controls, or did control, or is supposed to control, or to have controlled, or at least is supposed to control or to have controlled, or to have attempted to control or to have desired or intended to control, various subsidiary corporations, mostly of Senator Lewis's

previous manufacture, among this list being the Imperial Copper Co., Royal Gold & Copper Mining Co., Manhattan Copper & Gold Mining Co., Royal Gold & Copper Co. and New-England-Utah Mining Co. As most of these corporations are reorganizations, some raised to the nth power, and no information has been forthcoming from any of them, the task of verifying the alleged holdings of the Nevada-Utah Mines & Smelters is one that might well appall the the stoutest-hearted seeker after truth. If an injunction could be secured, restraining Senator Lewis from perpetrating any further incorporations for a reasonable period, it might be possible to untangle the skein, but with new material coming in at the front end faster than the old can be untwisted, assorted and labeled at the rear, the prospects for a really luminous exposition of the truth seem rather poor.

The landed holdings of the Nevada-Utah Mines & Smelters Corporation were supposed, in 1905, to consist of the Imperial, Montreal and Comet mines, in Beaver county, Utah, the Last Chance mine, at Bingham Canyon, Salt Lake county, Utah, and the Manhattan and Pioche Consolidated mines, and the Bullionville tailings, at Pioche, Lincoln county, Nevada. The Beaver county mines seem to have been mislaid accidentally, presumably in a moment of abstraction, and as near as can be learned, the holdings in 1906 include the Last Chance mine at Bingham, the Pioche group in Nevada and possibly the Imperial group in Beaver county, Utah. Whether these are held by direct title, or through subsidiary companies, has not been ascertained but it is considered probable that the properties are held through sub-companies.

The Last Chance group, formerly owned by the New-England-Utah Mining Co., has 13 claims, area 115 acres, lying southwest of the Boston Consolidated, in the West Mountain or Bingham district of Salt Lake county, Utah, showing sundry contact and fissure veins of 3′ to 50′ width, carrying good values in copper, lead, silver and gold, developed by tunnels aggregating 7,000′, and having about 2 miles of underground workings. Equipment includes a 100-ton concentrator, which was being remodeled, early in 1906. The Last Chance has been idle for several years, except for a little work by leasers, but is well located, and is considered a promising property.

The Imperial group, which includes the Comet mine, area 400 acres, lies near the Horn Silver, Cactus and Majestic mines. The Imperial group, developed by tunnels, has carbonate ores above and sulphides at little depth, assaying up to 30% copper, 15% lead, 18 oz. silver and $1 to $9 gold per ton. Ore is mainly of concentrating grade, but considerable high-grade ore has been shipped to smelters, from time to time. The Comet mine of the Imperial group, adjoining the Cactus, and having rail connections, undoubtedly carries a continuation of the Cactus vein of the Newhouse Mines & Smelters, and has considerable development, ore being mainly of concentrating grade, carrying fair values in copper, silver and gold.

Latest semi-authoritative data regarding the Nevada property of the Nevada-Utah Mines & Smelters Corporation give the Pioche holdings as 35 claims. The Manhattan group had 55 claims, and the Pioche group

had 63 claims, according to best available information in 1905. At any rate, the holdings, of the Nevada-Utah included, in June, 1906, two groups, formerly held by the Pioche Consolidated Mines Co. These mines were extensive producers of silver-lead ores, until closed down, 1893, and are popularly credited with a past production of $20,000,000. The May Day mine of this property has a shaft 1,100′ deep, and there are two old shafts on the Yuba mine, an adjoining property, and Meadow Valley No. 5 shaft, with 3 compartments, is 400′ deep. A 700′ Leschen ærial tram is being built from the May Day shaft to ore-bins on the mine's private railway, running from the mine to Pioche, which has been reconstructed and put in operation. Nearest outside railway is the San Pedro line, 28 miles distant. The Pioche has a good mining equipment and a 300-ton smelter, the latter somewhat antiquated in design and equipment.

The Bullionville tailings, which may or may not be included in the present holdings of the Nevada-Utah, contain circa 150,000 tons of sands and slimes, the residue from Pioche ores milled, assaying $16.43 per ton in gold, silver and lead, and which a modern concentrating and slimes plant should be able to rework at a good net profit.

The Pioche and Bingham properties controlled by the Nevada-Utah Mines & Smelters Corporation are properties of decided promise, and, with good management. should become large and profitable producers of copper, lead, silver and gold.

NEVER SWEAT MINE **MONTANA.**

Owned by Anoconda Copper Mining Co.

NEW AMERICAN MINING & MILLING CO. **UTAH.**

Letter returned unclaimed from former mine office, Brigham, Utah.

NEW ARIO COPPER & EXPLORATION CO., LTD. **MEXICO.**

Offices: 35, Lamb's Conduit, London, W. C., Eng. Mine office: Ario, Michoacán, Mex. R. Gautier, managing director; G. Harmant, secretary. Organized March 27, 1897, with capitalization £100,000, shares 4s. par: issued, £90,422. Property is sundry copper claims, near Ario. Idle.

NEW BALLA BALLA COPPER MINES, LTD. **AUSTRALIA.**

Offices: 6, Great St. Helen's London, E. C., Eng. Mine office; Port Balla Balla, Western Australia. T. W. Williams, chairman; E. A. Foster, secretary; W. H. Mitchell, legal manager in Western Australia. Organized Apr. 16, 1901, as a reconstruction of the Balla Balla Copper Mines, Ltd., with capitalization £250,000, shares £1 par; issued, £138,599. Lands, 63 acres, in two groups, in the Pilbarra district, 11 miles from Port Balla Balla. Has a 30-ton smelter, and a smelting test, 1905, is said to have given satisfactory results.

NEW BOSTON MINING CO. **MONTANA**

Office: Eden Valley, Minn. Mine office: Corbin, Jefferson Co., Montana. Ores carry gold and copper. Company advertises that it will make its shareholders wealthy, and that its stock is "fully guaranteed by 10-year gold bonds bearing 3% interest—50 per cent commission to agents—why not become a mining king?" Cannot be learned that any work is in progress, and company is a mere stock-jobbing scheme, of course.

NEWBURY MINING CO. **ARIZONA.**

Mine office: Florence, Pinal Co., Ariz. C. M. Schofield, manager. Is supposed to have resumed work, early in 1906.

NEW CALEDONIA COPPER CO., LTD. **NEW CALEDONIA.**

Reorganized, 1899, as Caledonia Copper Co., Ltd.

NEW CENTURY EXPLORATION & INVESTMENT CO. **IDAHO, OREGON & WASHINGTON.**

Office: care of J. W. McCoy, president; 500-125 La Salle St., Chicago, Ills. Mine office: Darrington, Snohomish Co., Wash. J. C. Morehouse, vice-president; Joseph G. English, treasurer; H. A. Burdick, secretary; T. T. Watson, assistant secretary; N. L. Franke, mine manager. Organized under laws of Arizona, with capitalization $7,500,000, shares $10 par. The Forrest-Chickamun mine, on Gold Mountain, near Darrington, area circa 400 acres, is claimed by company to have 700,000 tons of auriferous and argentiferous copper ore, worth $10 per ton, blocked out, and management claims that a 250-ton concentrating and smelting plant is to be erected, during 1906. Company also has gold claims in Elmore county, Idaho, and Baker county, Oregon. Claims of company seem excessive.

NEW CHILLAGOE RAILWAY & MINES, LTD. **AUSTRALIA.**

Title changed back, 1905, to Chillagoe Railway & Mines, Ltd.

NEW CLARA ST. DORA MINING CO. (NO LIABILITY.) **AUSTRALIA.**

Office: Port Adelaide, South Australia. Mine office: Alberin Creek, via Hergott, South Australia. Employs 12 men. F. S. Chany, chairman and secretary; H. Paull, manager. Organized March, 1898, under laws of South Australia, with capitalization £10,000, shares £1 par; issued, £5,345. Lands, 4 claims, area 160 acres, held under 40-year lease, in the Hergott district, showing limestone country rock, carrying an ore body, opened by shallow shafts and open-cuts, showing malachite and chalcocite, occurring as nodules in hard limestone, and as veins in soft limestone. Has a 38-h. p. steam plant, with hoist good for 400′ depth. Ores, as treated, average 26% copper, without gold or silver values. Has a small mill, with one crusher, 1 set of rolls and 1 Mays jig. Mine is served by the South Australian railway, 5½ miles distant. Production, 1905, was 15 long tons fine copper, andis estimated by the company at 25 tons for 1906.

NEW CLONCURRY COPPER & SMELTING CO., LTD. **AUSTRALIA.**

Offices: 116, St Vincent St., Glasgow, Scotland. R. L. Alston, chairman; B. F. G. Meldrum, secretary. Organized Oct. 29, 1895, with capitalization £3,300, shares 6s each. Lands, sundry small mines in North Queensland, idle for some years, pending construction of a hoped-for railroad.

NEW COLUMBIA MINING CO. **IDAHO.**

Mine office: Salmon, Lehmi Co., Idaho. Ores carry copper and gold. Has steam power and a 10-stamp mill. Presumably idle.

NEW DOMINION MINES CO. **ARIZONA.**

Mine office: Globe, Gila Co., Ariz. Organized 1905, with capitalization $1,000 000.

NEW ENGLAND-ARIZONA COPPER CO. **ARIZONA.**

Said to have been organized, 1906, to take over the Thiesing group of 17 claims, in the Crazy Basin, Yavapai county, Arizona. Possibly a reorganization of the New England & Arizona Copper & Gold Mining Co.

NEW ENGLAND-ARIZONA COPPER-GOLD MINING CO. **ARIZONA.**

Office: care of J. W. Stonehouse, Douglas, Ariz. Organized 1905, with capitalization $3,000,000, to take over sundry copper claims near Paradise, Cochise county, Arizona, and on Saddle Mountain, near Dudleyville, Pinal county, Arizona.

NEW ENGLAND & ARIZONA COPPER & GOLD MINING CO. **ARIZONA.**

Office: care of Louis Harlow, secretary and treasurer, 69 Pearl St., Boston, Mass. Letter returned unclaimed from former mine office, McCabe, Yavapai Co., Ariz. Edmund D. Fisk, president; Leonard T. Farris, vice-president. Organized January, 1901, under laws of Arizona, with capitalization $750,000, shares $1 par. Lands, 5 claims, known as the Red Star group, near the Silver Belt mine, in the Big Bug district. Has a steam hoist and about 300′ of underground openings. Possibly reorganized, 1906, as the New England-Arizona Copper Co.

NEW ENGLAND & CLIFTON COPPER CO. **ARIZONA.**

Office: 43 State St., Boston, Mass. Mine office: Clifton, Graham Co., Ariz. E. Rollins Morse, president; Arthur P. Ayling, general manager; C. C. Burger, consulting engineer. Capitalization $5,000,000, in $2,000,000 preferred 8% stock, cumulative after payment of first 8% dividend, and $3,000,000 common stock; issued, $1,000,000 preferred and $2,500,000 common stock. Present company succeeded the New England Copper Co. and the Clifton Consolidated Copper Mines of Arizona.

Lands, 78 claims, area 1,006 acres, circa 5 miles northwest of Clifton, on the north side of the San Francisco river. The Clifton had 7 shafts, of 70′ to 315′ depth, also tunnels of 220′, 450′, 700′, 800′, 1,000′ and 1,700′, and is opened to a depth of 800′. Ores are principally chalcopyrite and chalcocite, with occasional oxides and carbonates, all slightly auriferous and argentiferous. The main vein is said to show an extreme width of 150′. The New England is opened by shafts of 400′ and 500′ and a 2,000′ tunnel, showing fissure veins instead of the blanket vein noted at Clifton, 3 miles distant. Principal vein is 5′ to 6′ wide, carrying cuprite, chalcocite and chalcopyrite, all of very high grade. The various mines of the company show a large amount of ore, of all grades from very poor to very rich.

The mines have steam, gasoline and electric power. A 3-mile ground-tram, of 20″ gauge, is being built from the mines to the railroad, and when this is completed, the company plans shipping ores to the Shannon reduction works. Early in 1906 the mines were producing circa 25 tons daily, shipped under disadvantageous circumstances. Management is considered good, and property regarded as promising, though not yet developed to the point of large and profitable production.

NEW ENGLAND-COLORADO COPPER MINES CO. **COLORADO**

Letter returned unclaimed from former office, Denver, Colo. Capitalization $200,000, shares $1 par. Had lands in Fremont and Chaffee counties, Colorado.

NEW ENGLAND COPPER CO. **ARIZONA.**

Succeeded, circa 1904, by New England & Clifton Copper Co.

NEW ENGLAND GOLD & COPPER MINING CO. **UTAH.**

Office: 6-4-18 Tremont St., Boston, Mass. Mine office: Bingham Canyon, Salt Lake Co., Utah. Employs 28 men. D. W. Williams, president; E. E. Abercrombie, vice-president and managing director; Geo. F. Bradstreet, secretary and treasurer; preceding officers, James S. Williams, Thomas Kellough, Arthur P. Hosford and Dr. James R. Piper, directors; H. M. Adkinson, manager; D. J. Cook, mine and mill superintendent. Organized June, 1899, under laws of Colorado, with capitalization $1,000,000, shares $1 par; issued, $817,000. Bonds, $500,000 authorized, at 6%; issued, $108,000. Annual meeting, first Monday in June.

Lands, 9 fractional claims, patented, area 18 acres, in the West Mountain or Bingham district, showing porphyry country rock carrying 3 principal fissure veins, of 30″ average width, 1,000′ average length and known depth of 400′, opened by a 159′ shaft and 2 tunnels, known as the Nast, of 1,600′ and the Benton, of 1,670′ length, both driven on the vein, with a total of 5,600′ of workings. Ores give average assays of 30% lead, 10% zinc, 15 oz. silver and $4.50 gold per ton, with small and variable values in copper, in addition to which the monzonite country rock carries small copper values, and may be proven workable, later.

Property has a 30-h. p. hoist, good for 800′ depth, and a concentrator equipped with a 4x12″ Sturtevant crusher, 2 sets of rolls, 2 double Hartz jigs and 1 Wilfley table. Mine is served by the Denver & Rio Grande railroad, 2 miles distant. Production, 1905, was circa 600,000 pounds lead, 20,000 oz. silver and 110 oz. gold. Management plans extending mine openings, adding a complete electrical equipment to the power plant and enlarging the mill, during 1906. Property is considered well located, and promising.

NEW ENGLAND MINING CO. **MASSACHUSETTS.**

Office: 35 School St., Greenfield, Mass. Mine office: Charlemont, Franklin Co., Mass. Othello A. Fay, president; Capt. Geo. H. Davenport, treasurer and general manager. Organized 1902, with capitalization $500,000, shares $5 par. Lands, circa 1,000 acres, 2 miles west of the Davis pyrite mine, latter worked since circa 1880. Vein, traced circa 700′, is approximately vertical, conforming closely in dip and strike with the Savoy schist in which it occurs, and apparently is a fahlband, lacking well defined walls, ore occurring scattered through 15′ to 20′ of the schist, with a 6″ to 12″ vein of quartz, well mineralized, on the south wall, and a heavy impregnation of chalcopyrite, 1′ to 2′ wide, on the north wall. Has been partly stripped, and vein trenched across. Presumably idle.

NEW ENGLAND-UTAH MINING CO. **UTAH.**

Controlled by Nevada-Utah Mines & Smelters Corporation.

NEW ERA MINING CO. **MEXICO.**

Had copper claims, south of La Cananea, Sonora, Mexico, circa 1902.

NEWFOUNDLAND COPPER CO., LTD. **NEWFOUNDLAND.**

Absorbed, 1901, by Carmen Copper Mines, Ltd.

B. NEWGASS & CO. **SPAIN.**

Offices: 7, Lothbury, E. C., Eng. Lands, at Arrieta and Changoa, Navarra, Spain, include the Ollin, Arrieta and Changoa mines, carrying silver, lead and copper ores. Idle for some years.

NEWGATE MINE. **CONNECTICUT.**

An old and idle property, at Granby, Hartford county, Connecticut.

NEW HIGHLAND GOLD & COPPER MINING CO. **CALIFORNIA.**

Office: 1209 Broadway, Oakland, Cal. Mine office: Georgetown, El Dorado Co., Cal. Thos. F. Graber, vice-president; C. L. Colvin, secretary and treasure; Ira C. Jenks, financial secretary; J. A. Parker, superintendent. Organized Sept. 11, 1903, under laws of California, with capitalization $2,000,000, shares $1 par. Lands, 11 copper claims and 9 gold claims, area 555 acres, on the mother lode, in the Georgetown district, showing a fissure vein in slate, giving assays of 15% copper, 15 oz. silver and $2.50 gold per ton. Copper property is idle.

NEWHOUSE MINES & SMELTERS. **UTAH.**

Office: 71 Broadway, New York. Operating office: Salt Lake City, Utah. Mine office: Frisco, Beaver Co., Utah. Employs 285 men. Samuel Newhouse, president; L. N. Kramer, vice-president; John Josten, secretary and treasurer; Lafayette Hanchett, general manager; Alexander D. Moffatt, superintendent; A. J. Bettles, chief metallurgist; D. H. Waterbury, lixiviation superintendent; Victor Carlson, mine superintendent; Louis L. Bailey, mill superintendent; A. C. Dart, engineer.

Lands, in Copper Gulch, 7 miles from Frisco, are very extensive, including the Cactus group, which has had several previous ownerships, but never was a success, until taken over by the present company. Country rock is monzonite porphyry, and the Cactus mine is essentially a pyritic impregnation of a shear zone, in a body of monzonite, near a limestone contact. Ore is coarsely crystalline pyrite, carrying a little chalcopyrite, with very small gold and silver values, averaging perhaps 30 cents per ton, and practically without lead or zinc, averaging 2.5% copper. Company reports the main ore body as 175′ wide, 700′ long and 600′ deep, with a northwesterly strike and vertical dip. The mine has 2 shafts, of 600′ depth each, the main working shaft having 3 compartments, with levels opened, at intervals of 100′. The principal mine opening is a tunnel, of 6,200′ length, connected with the 600′ level of the shafts. The tunnel has a grade of 5%, and is laid with 30-lb. steel rails. Tramming is done by 2 electric locomotives, each hauling trains of 21 cars. The tunnel is electric lighted throughout, and cuts several cupriferous veins before reaching the main vein. The mine has about 2.5 miles of underground workings, estimated to show 4,000,000 tons of ore. A crosscut to the old French shaft shows a 50′ ore body, and 2 tunnels driven west therefrom show a 100′ ore body.

It is planned to extract a large portion of the ore mined by steam-shovels, beginning 1906. The ore will be blasted, with black powder, two men being capable of doing sufficient drilling and blasting, by cutting the ore down in slices, to supply one steam-shovel, handling 400 tons per 10-hour shift, with a crew of 6 men. The Newhouse tract carries upwards of one mile of the strike of the great Cactus vein, and also carries various smaller veins of higher grade ore, running up to 10% in copper tenor.

After reaching the portal of the main tunnel, the electric trains pass over a high trestle to an ore-building, where 7 cars at a time are run into a great steel tube, which is partially rotated, and the ore in the cars dumped onto grizzlies, oversize going to Blake crushers, that reduce it to lumps of 1″ size and smaller, fines and crushed ore going to 800-ton storage bins, whence the ore is loaded into railroad cars and taken to the mill. The mine has a 200-h. p. plant, including a 150-h. p. hoist, good for 600′, and works 35 power drills.

The mill, 2 miles from the mine, built of steel, is 100x400′ in size, in 2 duplicate sections, of 1,000 tons aggregate daily capacity. The western section, which is the concentrator proper, is of structural steel, with corrugated iron siding and roof, while the power plant, under the same roof, is of structural steel and brick. The concentrator is designed on the unit plan, allowing for future expansion. Equipment includes three 10x24″ Blake crushers, 4 sets of rolls, 18 Hartz jigs, 32 Wifley tables and 8 Wifley slimers, also a Hancock jig, which is doing the work of 8 Wilfleys, Sherman settling tanks and classifiers, and a 15-ton Whiting traveling crane. Ore is received and dumped into 1,000-ton steel bins, whence it is drawn out by belt-conveyors equipped with plunger feed, and transferred to elevators, of which they are two for each section, one for dry and one for wet ores. The mill is putting about eight tons into one, and is saving about 80% of the assay values. Early in 1906, Mr. D. H. Waterbury was installing a 40-ton experimental lixiviation plant, for leaching oxidized ores of the Cactus, averaging 2.5% copper and carrying small gold and silver values. The leaching plant embodies certain features patented by Mr. Waterbury.

The power plant includes five 350-h. p. Babcock & Wilcox water-tube boilers, and a Green fuel economizer, with a 165′ self-supporting steel smokestack, of 8′ diameter. There is a 2,500′ forty-drill Ingersoll-Sergeant air-compressor and two 500-h. p. Westinghouse-Parsons steam turbines, making 3,600 revolutions per minute, direct-connected to two 400-kw. Westinghouse generators that furnish all power, except compressed air, that is used in the mine and mill. Other buildings include a 30x50′ brick machine-shop, 40x50′ wood carpenter shop and a smithy.

The mine and mill are connected by the Newhouse, Copper Gulch & Sevier Lake Railroad, 2.3 miles in length, of standard gauge, owned by the company, and connecting with the San Pedro & Salt Lake railroad. The railroad has one Shay locomotive and 5 dump-cars. Power is furnished the mine by compressed air, piped through a line of 13,000′ length, which operates steam-shovels and hoists, water for steam purposes not being available

at the mine. Water is brought from 6 large springs, at Wah Wah, 8.5 miles from the mill, through a line of 12" and 14" riveted steel pipe, laid across Preuss valley and discharges into a cement reservoir of 300,000 gallons capacity, located on high ground above the mill and townsite, the springs having a flow of circa 1,050 gallons per minute. A townsite, called Newhouse, has been platted, near the mill, and the company owns therein 47 dwellings, a club-house, bunk-house, boarding-house and a brick hotel accommodating 150 men. Miscellaneous improvements include a sawmill and a 3-ton ice plant, the latter highly necessary in summer, as the property is on the edge of the Escalanta desert. Fuel is soft coal, costing $4.50 per ton.

Production was begun, March 15, 1905, and 125,000 tons of ore were treated during the year, making concentrates of circa 12% copper tenor, with a production of 5,670,993 lbs. fine copper, 53,862 oz. fine silver and 2,272 oz. fine gold. Production for 1906 is estimated by company as likely to be about 7,000,000 lbs. fine copper. Mining cost was $1.75 per ton and milling cost 70 cents per ton, during 1905, but these costs probably can be reduced greatly and the cost of mining with steam-shovels should reach 50 cents per ton eventually. The development of this property has been slower than was expected, but the work has been done along thoroughly sound lines, and it is probable that ore production will be increased to 2,000 tons daily, within two or three years, and eventually to 3,000 tons per diem, or more, as the ore bodies are of immense size, though low in grade, and the future profits of the company depend largely upon securing a maximum tonnage.

NEW JERSEY METAL REFINING WORKS, LTD. **NEW JERSEY.**

Works office: Elizabeth, N. J. Owned by Mountain Copper Co., Ltd.

NEW LINCOLN COPPER CO. **WYOMING.**

Office: Chicago, Ills. Mine office: Holmes, Albany Co., Wyo. W. J. Sherwood, president; Dorchester Mapes, vice-president; W. S. Smyth, Jr., secretary; C. A. Louckes, treasurer. Organized under laws of Wyoming, with capitalization $1,000,000, shares $1 par; issued $650,000. Lands, 2 claims, patented, area 40 acres, lying north of and adjoining the Rambler mine, on which shafts of 30′ and 50′, sunk to cut the extension of the Rambler vein, are said to show auriferous and argentiferous copper ore.

NEW LONDON MINE. **MARYLAND.**

Office: care of Capt. Edward S. Wertz, owner, Washington, D. C. Property, in Frederick county, Maryland, includes 64 acres of mineral land and 14 acres of timber land. Mine was worked, 1835-1855, and is said to have yielded a profit. Idle since 1888, until 1903-04, when unwatered and shaft retimbered, but no ore extracted. Ores are bornite and chalcocite, in a vein of 3′ to 4′ in dolomite, with bands of phyllite, ores assaying 3.5% to 70% copper. Has 4 tunnels, longest 104′, and a 210′ shaft, with about 500′ of underground openings. Idle.

NEW MAMMOTH MINING & MILLING CO. **UTAH.**

Mine office: Bingham Canyon, Salt Lake Co., Utah. Ores carry gold, silver and copper. Has steam power. Idle.

NEW MEXICO COPPER MINING & SMELTING CO. **NEW MEXICO**

Letters returned unclaimed from former office, Hartford, Conn., and former mine office, Lucera, Mora Co., N. M.

NEW MEXICO DEVELOPMENT CO. **NEW MEXICO.**

Mine office: Fierro, Grant Co., N. M. Idle.

NEW MEXICO GOLD & COPPER MINING CO. **NEW MEXICO.**

Office: 39 Cawker Bldg., Milwaukee, Wis. Mine office: Tres Piedras, Rio Arriba Co., N. M. Wm. H. Devos, president; M. D. Kelly, secretary and treasurer; Richard Cole, superintendent. Organized 1897, under laws of New Mexico, with capitalization $2,500,000, shares $1 par. Lands, 11 claims, area 140 acres, in the Bromide district, showing fissure veins in schist, and contact veins between schist and granite. Five veins are being developed, these averaging 7′ in width and giving assays of 5% to 40% copper, from native copper, carbonate and sulphide ores, with occasional high values in gold. Has a 130′ shaft and 265′ of underground openings, with steam power and a Norwalk air-compressor. Company platted a townsite, called Bromide City, and endeavored to replenish its depleted exchequer by sale of town lots, in addition to which a $25,000 issue of 7% gold bonds is being offered shareholders. Apparently company is hopelessly involved.

NEW MICHIGAN COPPER MINING CO. **WYOMING.**

Office: Laramie, Wyo. Idle.

NEW MOUNT HOPE COPPER MINING CO., LTD. **AUSTRALIA.**

Mine office: Mt. Hope, N. S. W., Australia. R. M. Kirk, general manager. Mine, opened 1878, is about 90 miles south of the Great Cobar. Ores are mainly chalcopyrite and bornite, with sandstone gangue, in a country rock of ferruginous slates and sandstones, with oxidized ores mainly earthy carbonates above the 250′ level, deepest shaft being 400′. Ore bodies, having an extreme width of 80′, occur as replacements in the country rock, without defined walls. General formation and physical features resemble the Great Cobar mine. Ore is concentrated about 5 into 1, and is smelted in a plant having 5 small furnaces, using iron ore, secured 12 miles distant, for a flux. Made 5,070 long tons fine copper, 1878-1898, inclusive.

NEWPORT & ARIZONA COPPER & GOLD MINING CO. **ARIZONA.**

Letter returned unclaimed from former office, 60 State St., Boston.

NEW RED WING MINING CO. **UTAH.**

Succeeded, 1905, by Utah Development Co.

NEW RIO TINTO COPPER CO., LTD. **SPAIN.**

Absorbed, circa 1904, by Caridad Copper Co., Ltd.

NEW RIVER COPPER CO. **ALABAMA.**

Office: care of F. W. Pratt, Huntsville, Ala. Organized August, 1902, under laws of Delaware, with capitalization $1,000,000. Presumably idle.

NEW ST. ELMO GOLD & COPPER CO.

Office: 45 Broadway, New York.

NEWS BOY COPPER MINING CO. **WYOMING.**

Letter returned unclaimed from former mine office, Encampment, Wyo.

Lands, sundry claims, on Beaver Creek, circa 12 miles south of Encampment, on which considerable development work has been done.

NEWS COPPER MINING CO. **ARIZONA.**

Mine office: Jerome, Yavapai Co., Ariz. J. D. Dennis, superintendent. Lands, sundry claims, 1½ miles southeast of Jerome. Shaft was unwatered and retimbered, 1905, after several years' idleness, and property was investigated by F. August Heinze, but was not taken by him, as it failed to prove as represented.

NEW SLEEPY HOLLOW GOLD MINING CO. **COLORADO.**

Mine office: Black Hawk, Gilpin Co., Colo. Ores carry gold, silver and copper. Has steam power.

NEW STATE COPPER MINING CO. **ARIZONA.**

Office and mine: Tucson, Pima Co., Ariz. James W. Bogan, president; Chas. Bent, vice-president; Lyman W. Wakefield, treasurer; Ralph K. Shelton, secretary. Lands, 10 claims, circa 10 miles west of Tucson, showing country rock of limestone, with a prominent gossan, carrying oxidized ores and a little chalcocite with gold and silver values, suitable for fluxing ore, and presumably underlaid by copper ores of fair tenor. Development is by a 40′ shaft, showing a little chalcopyrite, and by a short tunnel.

NEWTON COPPER CO. **CALIFORNIA.**

Office: 420 Montgomery St., San Francisco, Cal. Mine office: Ranlett, Amador Co., Cal. Horace D. Ranlett, president and general manager. Organized 1887, under laws of California, with capitalization $200,000, shares $5 par. Lands, 100 acres, patented, showing 3 fissure veins in slate, carrying an average of 8% copper, mainly in sulphide ores. Mine, opened 1861, has shafts of 200′ and 430′, with about 20,000 tons of ore in sight. Has steam power, and smelter with an 80-ton water-jacket blast-furnace, also a 100-ton leaching plant, ore being especially adapted to lixiviation. Idle since circa 1903.

NEW UTAH MINING CO. **UTAH.**

Office: Salt Lake City, Utah. Hugh Heffernan, president; W. W. Thompson, vice-president; Geo. A. Udall, secretary; James Norman, treasurer; Timothy Manion, manager. Lands are in Tooele county, Utah, near the Flying Dutchman mine.

NEWTON MINE. **WYOMING.**

Mine office: Encampment, Carbon Co., Wyo. Lands, near Elwood, 7 miles from Encampment, are opened by a 125′ shaft, said to show a 12′ vein.

NEW VELVET-PORTLAND MINE, LTD. **BRITISH COLUMBIA.**

Offices: 535, Salisbury House, London, E. C., Eng. Mine office: Rossland, Trail Division, Yale district, B. C. Allan Maclean, chairman; F. A. Labouchere, secretary; S. Severin Sörensen, general manager. Organized November 18, 1905, as successor of the Velvet-Portland Mine, Ltd., with capitalization £10,000, shares £1 par. Lands, sundry claims, on Sophie Mountain, Rossland, carrying auriferous copper ores, said to average circa $14 per ton in value. Has a 75-ton concentrator with three Tremaine two-stamp mills, 2 Overstrom tables, two sets of Brown's hydrometric classifiers, and one Jenckes

crusher, putting five tons into one. Concentrates are sent to the Northport smelter, for treatment. Has a good steam plant.

NEW VIGSNAES COPPER CO., LTD. **NORWAY.**

Offices: 29, St. Mary St., Cardiff, Wales. H. A. Evans, secretary. Organized October 28, 1905, with capitalization £10,000, shares £1 par, to acquire the Vigsnaes copper mine, on Karme Island, Norway.

NEW WORLD SMELTING CO. **MONTANA.**

Office: 306 Pacific Blk., Seattle, Wash. Mine office: Gardiner, Park Co., Mont. Dr. G. L. Tanzer, president. Lands, sundry claims, 60 miles from Gardiner and 3½ miles east of Yellowstone National Park. Company is said to have contracted with the Colorado Iron Works Co. for a 100-ton copper matting furnace, and to plan installing a lead stack also. Installation planned is said to include a hydro-electric plant, with McCormick turbine water-wheels, direct connected to Bulluck generators.

NEW YELTA COPPER MINING & SMELTING CO., LTD. **AUSTRALIA.**

Mines, sold, 1903, to Paramatta Copper Mines, Ltd.

NEW YORK-ALASKA MINE. **ALASKA.**

Office: care of Saml. I. Silverman, general manager, Ketchikan, Alaska. Property is near the Brown-Alaska, on Prince of Wales Island.

NEW YORK & ARIZONA COPPER MINING & SMELTING CO. **ARIZONA.**

Office: 261 Broadway, New York. Letter returned unclaimed from former mine office, Globe, Gila Co., Ariz. Lionel Hagenaers, president; E. G. Macqueston, secretary. Organized 1901, with capitalization $3,000,000, shares $10 par, to sell stock. Property considered promising, but company not.

NEW-YORK CANADIAN COPPER CO., LTD. **ONTARIO.**

Presumably dead, as company was in financial straits, 1905, and property, the Tip Top mine, is owned by Col. S. W. Ray, 1906.

NEW YORK COPPER MINING & SMELTING CO. **ARIZONA.**

Letter returned unclaimed from former office, Tucson, Ariz. F. H. Lee, president; E. J. Tripple, secretary; H. Buehman, treasurer. Lands were 6 claims, in the Helvetia district, Pima county, on which a little prospecting has been done.

NEW YORK MINE. **ARIZONA.**

Office and mine: care of T. R. Nellis, owner, Williams, Coconino Co., Ariz.

NEW YORK MINE. **ARIZONA.**

Office: care of Henry J. Bennett, owner, Phoenix, Ariz. Mine office: Morristown. Maricopa Co., Ariz. Has a 100′ shaft, on a 3′ vein, also a 15′ vein said to give assays up to 60% copper.

NEW YORK & MONTANA COPPER MINING CO. **MONTANA.**

Office: 32 Broadway, New York. Mine office: Corbin, Jefferson Co., Mont. J. H. McCabe, general manager; E. J. Mathews, superintendent. Organized 1903, under laws of Delaware, with capitalization $1,000,000, shares $1 par. Lands, circa 250 acres, including the Erickson, Scioto and Copper Gulch groups, opened by 3 two-compartment shafts, which are said to make a good showing of medium-grade ore. Presumably idle.

NEW YORK & NEVADA COPPER CO. **NEVADA**

Liquidated, 1905. Fully described in Vols. III and IV.

NEW YORK-SEATTLE COPPER MINING CO. **WASHINGTON.**

Office: 237 Broadway, New York. Mine office: Index, Snohomish Co., Wash. Harry D. Cowden, president; Philip Hingston, treasurer; R. H. Hingston, superintendent. Organized August 17, 1901, with capitalization $1,000,000, shares $1 par. Lands, 8 claims, area 160 acres, well timbered and watered, with an available water-power, 13 miles from the Great Northern railroad, with a good wagon-road between, in the Mineral City and Silver Creek districts. Mine is developed by a 212′ shaft and circa 1,250′ of tunnels, showing 4 veins, of 4′ to 20′ average width, carrying copper ore, presumably with gold and silver values, that has given average returns of $14.42 per ton, in mill tests. Equipment includes a hydraulic power installation, air-compressor and sawmill, and, early in 1906, plans were being drawn for a 100-ton concentrator. Management seems to be developing the property vigorously, and the mine was being worked double-shift, at last accounts.

NEW YORK & VIRGINIA COPPER CO. **VIRGINIA.**

Office: 31 Nassau St., New York. Mine office: Woltz, Carroll Co., Va. Ambrose C. Dunn, president and general manager; Wm. D. Boggs, secretary and treasurer; James Lawson, superintendent. Organized 1901, under laws of West Virginia, with capitalization $2,500,000, shares $1 par. Lands, 740 acres, showing 7 cupriferous fissure veins and 2 gold veins, with 2 copper veins developed by shafts of 372′ and 381′ and by two tunnels of 100′ each. Main vein is claimed by company to average 96′ width, and to show argentiferous melaconite, bornite and chalcopyrite, carrying 10% copper, 25 oz. silver and 1 oz. gold per ton, which is more than the facts warrant. Has steam power. Claims to have about 40,000 tons of smelting ore on the dumps, with a larger amount blocked out for stoping. Presumably idle.

NEW ZEALAND COPPER ESTATES, CO., LTD. **NEW ZEALAND.**

Moribund.

NIAGARA COPPER CO. **ARIZONA.**

Office and mine: Prescott, Yavapai Co., Ariz. Herman Voge, president and general manager; John P. Bauder, secretary. Lands, 7 claims, in the Copper Creek district, near the Hillside property, 25 miles southwest of Prescott, opened by shafts of 60′, 60′ and 125′, also several tunnels, showing a vein of 50′ to 150′ width, with footwall and hanging-wall paystreaks that have given assays up to 54% copper, 9 oz. silver and $1.65 gold per ton. Property considered promising.

NIAGARA MINING & DEVELOPMENT CO. **BRITISH COLUMBIA.**

S. Arden Singlehurst, manager, at last accounts. Lands are in Kitsalas Cañon, on the Skeena river, in the extreme northern part of British Columbia, near the Alaskan line. Presumably idle.

NIAGARA MINING & SMELTING CO. **UTAH.**

Mine office: Bingham Canyon, Salt Lake Co., Utah. Is controlled, through ownership of majority of stock, by United States Mining Co., which operates the mine.

NIBLACK COPPER CO. **ALASKA.**

Offices: 310 American Trust Bldg., Cleveland, Ohio, and 29 University Bldg., Milwaukee, Wis. Mine office: Niblack, Prince of Wales Island, Alaska. M. P. O'Brien, president and treasurer; F. B. Richards, vice-president; S. C. Vessy, secretary; Benedict Crowell, consulting engineer; Burton B. Nieding, general manager; Wm. N. Fink, engineer. Organized October 12, 1904, under laws of Arizona, with capitalization $250,000.

The geology of this property is similar to that of the Ketchikan district, on the mainland, showing sedimentary deposits, mainly limestone of Devonian or Silurian age, having a general dip to the southwest, with intrusions of later eruptive rocks, that have forced their way between the beds, and altered them to such an extent that identification is difficult. The greenstone, in various phases of alteration, carries a mineralized zone parallel to the fault planes, with ore-bodies having a general strike of northwest to southeast, with dip of circa 60° to southwest. The principal ore body is a lense in greenstone, having a width of 60′, with another ore body on the 160′ level, estimated at 20′ width, and a third lense outcropping on the mountain above the mine. Ore is chalcopyrite, averaging circa 4% copper, and high in iron and sulphur, with combined gold and silver values of about $1.50 per ton, carrying circa 25% iron, 25% sulphur and 30% silica. Property also shows covellite and chalcopyrite, in quartz-sericite schists, at present undeveloped.

The lands are heavily timbered, and have a lake capable of developing 2,000 to 3,000 h. p., under a working head of 290′. Equipment includes a steam hoist, good for 1,000′, and a 6-drill air-compressor. Buildings include a power-house, machine-shop, carpenter-shop, smithy, office, general store, boarding-house and sundry cabins for the miners. Large ore-bunkers, near the shaft, are connected by tramway with a 700′ wharf. Tramway and wharf are double-tracked, and the tram is operated by gravity. The wharf is on Niblack Anchorage, a nearly landlocked harbor having deep water, but high tides, necessitating a long wharf, which is built with pockets, similar to those at the great iron shipping ports of Lake Superior.

The company has contracted to furnish 50,000 tons of ore to the Tacoma Smelting Co., but owing to insufficient shipping facilities, forwarded only 10,209 tons during 1905, giving an estimated output of 850,000 lbs. fine copper. A freight-rate of $1 per ton, to Tacoma, has been secured, which is a very favorable figure for a distance of 600 miles, along the inside passage, the Niblack Copper Co. having been the first Alaskan mine to make regular contracts, with a transportation line, for a set ore tonnage of large volume.

NICHOLS CHEMICAL CO. **QUEBEC & NEW YORK.**

Office: 25 Broad St., New York. Mine office: Capelton, Sherbrooke Co., Quebec. Works office: Laurel Hill, N. Y. Employs 250 men. W. H. Nichols, president; J. B. F. Herreshoff, vice-president; J. M. Luther, secretary; E. R. Nichols, treasurer; S. L. Spofford, mine manager.

The mine, at Capelton, area 640 acres, carries lenses of chalcopyrite and iron pyrites, former averaging 5% copper and latter 38% sulphur. Development is by 6 shafts, 4 of which are of less than 500′ depth, one of 800′ and one

of 2,000′ depth, with circa 5 miles of underground workings. The mine has steam power, a 150-ton concentrator and a smelter, latter turning out 50% matte, when working.

The Laurel Hill works include a smelter and electrolytic refinery, using steam and electric power. Material treated is mainly ores and mattes from outside producers, in the smelting works, and western blister copper in the electrolytic plant. The works have 10 reverberatory furnaces, taking 40-ton charges, with hearth-linings of quartz sand, containing a small quantity of feldspar. Each reverberatory furnace heats a tubular boiler with waste gases. The plant has two 46x120″ Herreshoff water-jacket blast-furnaces, of 210 tons daily capacity each. Matte and slag flow, in an uninterrupted stream, to a large settler, whence slag skims into pots, and the matte is tapped off into an iron bed. Fuel charges average 14%. Waste gas passes into a 1,000′ main flue, of iron and brick, leading to a 300′ chimney. About 100 tons of flue-dust are recovered monthly, and are briquetted and resmelted. The first-fusion product is a matte containing 40% to 60% copper, circa 20% iron and 20% to 40% sulphur. Matte is resmelted in water-jacket blast-furnaces, with 9% coke charges, and the product is tapped into converter shells, 12 in number, with 4 stands, tilted by hydraulic accumulators. Linings are made of 85% crushed quartz and 15% clay, ground and mixed in 3 silica mills with revolving bottoms, linings being tamped by hand, to a thickness of 18″. The linings last from 10 to 16 blows, and the shells vary in capacity, according to state of linings, from 2 tons to 6 tons each. The converter blast, at only 8 to 10 lbs. pressure per square inch, is furnished by 100-h. p. and 120-h. p. Connersville blowers. The final converter product is blister copper, assaying 99% to 99.5% copper, 50 oz. to 100 oz. silver and 1 oz. to 2 oz. gold per ton. Anodes are cast by a Herreshoff casting-table with 9 moulds, and after electrolytic refining. cathodes are melted down in 8 reverberatory furnaces, taking charges of 30 to 45 tons each.

The electrolytic plant is operated on the series system, with a current of 800 amperes, at 155 volts, generated by 17 dynamos. Anodes are cast ½x16x59″, with an average weight of 67 pounds, and are smoothed by passing between rolls, after casting. The final product is cast mainly into wire-bars, in moulds which are painted with a mixture of lampblack and benzine after each casting. This company enjoys a deservedly high reputation for the purity of its product, and the efficiency of its metallurgical practice.

NICKEL-COPPER CO. **ONTARIO.**

Office: Worthington, Ont. Lands are in Drury township near Sudbury, Algoma, Ontario. Experimented with a new process of reducing nickel-copper ores, with the usual result of failure. Affairs were botched by management, but property is considered promising. Idle for several years.

NICKEL PLATE MINE. **BRITISH COLUMBIA.**

Mine office: Hedley, Yale district, B. C. A. Munson, manager. Ores carry gold, silver and copper. Has water and electric power and a 40-stamp mill. A very promising property, but is primarily a gold and silver mine, the copper values being small.

NICKELS COPPER CO.

Incorporated May, 1905, under laws of Maine.

NIGHT HAWK MINING CO. **WASHINGTON.**

Office: 201 Uihlein Bldg., Milwaukee, Wis. Mine office: Loomis, Okanogan Co., Wash. Edwin Reynolds, president; H. D. James, secretary and general manager; Chas. A. Druse, treasurer; preceding officers, P. Meehan, A. W. Schweder, and Edward Kolb, directors; Chas. T. Peterson, superintendent. Organized 1901, under laws of Montana, with capitalization $5,000,000, shares $1 par. Lands, 55 full and 10 fractional claims, area circa 1,250 acres, also 150 acres miscellaneous lands, including a millsite and townsite, on Mount Ellemeham, in the Wannicut Lake district, 68 miles from a railroad, lack of which has greatly hampered development, but it is expected the Victoria, Vancouver & Eastern Railroad will pass through the company's holdings. Development is by 3 shallow shafts and 4 tunnels, longest 1,200′. Property shows numerous fissure veins, of which 5 have been more or less developed, these ranging 6′ to 10′ in width, and carrying estimated average values of 8% copper and 1 oz. gold per ton, which probably is an excessive estimate. Property is considered promising.

NIPPER CONSOLIDATED COPPER CO. **MONTANA.**

Lands sold, 1906, to Butte Coalition Mining Co.

NIPPER MINE. **MONTANA.**

Owned by Butte Coalition Mining Co.

NISHINOKAWA MINE. **JAPAN.**

Mine office: Oboki-mura, Nii-gori, Iyo, Japan. Ores are chalcopyrite, associated with iron pyrites, hematite, magnetite and sphalerite, in a quartz gangue, averaging 3% to 4% copper and occurring as lenses 3′ to 12′ thick, in quartz-schists. Production, 1900, was 183,415 lbs. fine copper

NIZINA GOLD & COPPER CO., OF ALASKA. **ALASKA.**

Office: care of S. Thornton Langley & Co., Seattle, Wash. Lands, 25 placer gold claims and 7 copper claims, on the Nizina river, a tributary of the Copper river, Alaska, showing native copper. Property may prove valuable, if properly developed, but was lied about shamefully, in the advertisements of its fiscal agents, when peddling stock. Presumably idle.

N'KANDHLA SYNDICATE, LTD. **ZULULAND.**

Offices: 1, Great Winchester St., London, E. C., Eng. A. Lee, secretary. Organized March 13, 1902, with capitalization £2,000, shares £1 par; issued, £1,800. Property is prospecting rights over 4 blocks, each 600 yards square, on the Umhlatuzi river, N'Kandhla district, Zululand. Moribund.

NOBLE MINING & MILLING CO. **MONTANA.**

Office: 209 Railway Exchange Bldg., St. Louis, Mo. Mine office: Sheridan, Madison Co., Mont. S. M. Kennard, president; J. H. Wyeth, secretary and treasurer; D. H. Noble, general manager. Organized 1887, under laws of Montana, with capitalization $2,000,000, shares $10 par. Lands, 7 claims, area 75 acres, patented, also a 20-acre millsite, in the Wisconsin district, show a country rock of gneiss, carrying silicious sulphide ores, of which two 4′ veins are developed by a 200′ shaft, and by tunnels of 160′, 200′, 333′ and 2,150′,

showing ores averaging 1.5% copper, 10 oz. silver and $60 gold per ton. Equipment includes a small hoist and a 2-drill Ingersoll-Sergeant air-compressor. Has a small concentrator and a 10-stamp mill. Property said to have been leased by the company to an independent operator.

NOGALES COPPER CO. **ARIZONA & MEXICO.**

Reorganized, 1904, as Black Mountain Mining Co.

NOME-MONTANA-NEW MEXICO MINING CO. **NEW MEXICO.**

Office: 415 Iron Blk., Milwaukee, Wis. Jas. M. Kerr, president. Claimed in advertisements to have gold property at Nome, Alaska, copper claims adjoining the Copper Cliff mine in Montana, and 60 acres of copper lands in the Bromide district of the Rio Arriba county, New Mexico. A little work has been done on the New Mexico claims. Regarded with suspicion.

NONESUCH MINE. **MICHIGAN.**

Office: care of Arthur K. Camp, 78 Prospect Ave., Milwaukee, Wis. A. K. Camp and M. P. O'Brien owners. Lands, 640 acres. Is under option to the Calumet & Hecla Mining Co. Is the pioneer and principal mine of the Porcupine Mountain district of Ontonagon county, Michigan. Total production, 182 tons, 1,072 pounds fine copper. Mine carries native copper freely in an argillaceous conglomerate-sandstone. Idle for many years, but it is planned to test the lands by diamond drills during 1906. Very fully described in Vol. II.

SOCIEDAD FRANCESCA DE MINAS y FUNDICION DE NONOGASTA. **ARGENTINA.**

Mine office: Nonogasta, Rioja, Argentina. Property includes the Andueza, Santo Toribio and other mines, the ores of the Andueza being claimed to average 5% to 7% copper, 30 oz. silver and 2 oz. gold per ton. Has steam power and a small smelter.

NORMANBY SYNDICATE. **AUSTRALIA.**

Mine office: Mt. Perry, Tenningering, Queensland, Australia. Lands, 240 acres, freehold. Vein is parallel to that of the Mt. Perry mine, with similar geological conditions, and is opened to a depth of about 200'. Ore, averaging about 13% coppe and 10 dwts. to 15 dwts. gold per ton, is sent to the Aldershot smelter for reduction. Under lease, expiring June, 1907, to Queensland Copper Co., Ltd.

NORMANTON-CLONCURRY RAILWAY & COPPER MINES, LTD. **AUSTRALIA.**

Title changed, 1902, to North Queensland Railway Co., Ltd.

NORSK-BELGISK MINEKOMPANI. **NORWAY.**

Mine office: Melhus, Flaa sogn, Norway. Lands are in the Röros district, and company was working a fahlband, in a small way, at last accounts.

NORTH AMERICAN COPPER CO. **WYOMING.**

Was succeeded, September, 1904, by the Penn-Wyoming Copper Co., for which stock was exchanged by some of the shareholders. All assets of the North American Copper Co. were pledged, as security for a large indebtedness, to the International Trust Co., of Denver, presumably acting as trustee, and, on December 15, 1904, were sold by the trust company, for a sum much less than

the principal and interest of its debts. Sundry shareholders, who did not secure Penn-Wyoming stock in exchange, have brought suit against the Penn-Wyoming company, alleging collusion and fraud.

NORTH AMERICAN EXPLOITATION CO. ARIZONA & MONTANA.

Office: care of Western Trust & Guaranty Co., 327 New York Life Bldg., Chicago, Ills. William R. Everett, president; Chas. W. Cheney, vice-president; Davis Ewing, secretary; Western Trust & Guaranty Co., treasurer; Frank F. Day, managing director; Frank A. Summerilh, assistant general manager; Emery W. Fisher, general mine superintendent. Capitalization $10,000,000, shares $1 par. Controls, or did control, under lease, the Rambler Mining & Smelting Co., of Wyoming, Mormon Girl Mining Co., of Arizona, Bradshaw Mining Co., of Arizona, and sundry gold mining companies. The North American Exploitation Co. claimed to own 54% of the Rambler stock 91% of the Bradshaw and 96% of Mormon Girl stock. Company has sold stock on a special repayment contract, alleging that under these terms investments will be repaid in full, with interest, and that the stock is certain to advance immediately upon the installation of smelters. The plan of promotion is a self-evident delusion, as no corporation, even those of the most philanthropic intent, sells stock that is backed by a thoroughly sound guaranty. Stockholders must take their chances, and a guaranteed stock always should be viewed with distrust. Company claimed, in an advertisement, March, 1906, to have 40,000 tons of ore developed, ready for smelting, and to plan installing copper furnaces, of same patent design, at each property, in the near future, notwithstanding which the Mormon Girl property, controlled by this company, was sold for debt, early in 1906, this property bringing the truly magnificent price of $400, cash, at sheriff's sale. Company is regarded with deep suspicion.

NORTH AMERICAN EXPLORATION CO. ARIZONA.

Mine office: Gilbert, Yavapai Co., Ariz. Geo. W. Middelton, superintendent. Ores carry gold and copper. Has gasoline power.

NORTH AMERICAN MINING CO. NEW MEXICO.

Office: 615 Commercial St., Shamokin, Pa. Mine office: Lordsburg, Grant Co., N. M. Thos. A. Lister, president and general manager; W. P. Caldwell, secretary; W. E. Hoskin, superintendent. Organized under laws of New Mexico, with capitalization $1,200,000, shares $2 par. Lands, 11 claims, area circa 190 acres, in the Virginia district, including the Cobra Negra group, carrying fissure veins in porphyry, showing argentiferous oxide, carbonate and sulphide ores, giving assays of 18% copper, 15 oz. silver and $10 gold per ton, developed by a 178′ shaft. The Robert E. Lee mine is claimed to show argentiferous bornite at a depth of 60′. Ore bodies are stated, by a person not connected with the company, to carry flakes of native copper, in absolutely unpayable percentages. Equipment includes steam power, mine buildings and 4 dwellings. Railroad is 4 miles distant. Company is said to plan shipping, during 1906.

NORTH AMERICAN MINING CO. OREGON.

Office: care of D. W. C. Nelson, secretary and general manager, Baker

City, Ore. Mine office: Burkemont, Baker Co., Ore. Samuel Clough, president; W. G. Sanderson, vice-president and superintendent. Organized 1898, with capitalization $500,000, shares $1 par, and reorganized 1905, when old management was eliminated.

Lands, 807 acres, also 920 acres miscellaneous lands, in the Burkemont district, carrying a mineralized zone up to 500′ in width, opened by numerous pits and trenches, with an incline shaft, claimed by old officers to be 300′ in depth, but which apparently has shrunk to a depth of 180′ under the new management, and which the latter plans sinking to 500′ depth. Property shows sulphide ores assaying up to 10% copper, with gold and silver values, and a little native copper. Equipment includes a first-motion hoist and small air-compressor. The old management lied atrociously in its advertisements, but new officials apparently had no connection with the old.

NORTH AMERICAN PROSPECTING & MINING ASSOCIATION. COLORADO.

Office: 405 Temple Court Bldg., Denver, Colo. Mine office: White Pine, Gunnison Co., Colo. Chris. C. Sierk, president and general manager; Jas. T. Chase, secretary; Daniel C. Tobin, superintendent. Lands, 60 acres, showing 7 contact veins, between limestone and shale, giving average assays of 2% copper, 25% lead and 20% zinc, from carbonate and sulphide ores. Has water power and a small concentrator, making 55% zinc concentrates and 55% lead concentrates, carrying copper and gold values, when working. Presumably idle.

NORTH ARKANSAS ZINC, LEAD, COPPER, SILVER & GOLD MINING CO. ARIZONA, ARKANSAS & CALIFORNIA.

Office: 380 Wilcox Bldg., Los Angeles, Cal. J. M. Graybill, president and general manager; M. H. Wells, secretary; J. H. Arbuckle, superintendent. Is commonly known as the Five Metals Co. Organized 1902, with capitalization $5,000,000, shares $1 par. Lands, 25 claims, area 500 acres, 18 miles east of Randsburg, in the Spangler district of San Bernardino county, California, sundry claims near Morristown, Maricopa county, Arizona, and 800 acres of undeveloped zinc lands near Mt. House, Baxter county, Arkansas. Is idle, and without funds, but it is reported by management to be free from debt.

NORTH BINGHAM MINE. UTAH.

Said to be under bond to Samuel Newhouse.

NORTH BUTTE MINING CO. MONTANA.

Office: 508 Lyceum Bldg., Duluth, Minn. Mine office: Butte, Silver Bow Co., Mont. Employs 600 men. Jas. Hoatson, president; Chas. A. Duncan, vice-president and treasurer; Jos. Cotton, second vice-president and solicitor; preceding officers, Wm. J. Olcott, John Uno Sebenius, Chester A. Congdon, James Gayley, Thomas F. Cole and Daniel Clemson, directors; Frederic R. Kennedy, secretary; Arthur C. Carson, general manager. Organized April 5, 1905, under laws of Minnesota, with capitalization $9,000,000, shares $15 par; issued, $6,000,000. Paid, during 1905, two dividends, aggregating $500,000, and in March, 1906, paid dividend No. 3, of $500,000. Mine properties were bought for cash, at a cost of $7,035,495.71. American Loan & Trust Co.,

Ltd., and include a number of old workings, presumably dating from Roman times.

NORTH COAST COPPER CO. **WASHINGTON.**

Office: Everett, Wash.

NORTH CROWN LYELL MINE. **TASMANIA.**

Lands sold to Mt. Lyell Mining & Railway Co., Ltd.

NORTHEAST BUTTE COPPER MINING CO. **MONTANA.**

Mine office: Butte, Silver Bow Co., Mont. Organized April, 1906, with capitalization $1,000,000. Lands are sundry newly located claims, north and west of the Butte & Bacorn.

NORTHERN CALIFORNIA INVESTMENT CO. **CALIFORNIA.**

Owns the Black Diamond group, in the Stillwater district of Shasta county, California. Geo. Bayha, vice-president and general manager. Has large holdings, on which several low-grade ore bodies of considerable size have been located. Idle at last accounts.

NORTHERN COPPER (B. S. A.) CO., LTD. **RHODESIA.**

Offices: Salisbury House, London, E. C., Eng. Mine office: Bulawayo, Rhodesia, South Africa. Lord Gifford, V. C., chairman; preceding officer, E. Davis, H. Wilson Fox and P. C. Tarbutt, directors; Bechuanaland Exploration Co., Ltd., manager in South Africa; Percy Tarbutt & Co., consulting engineers; Thos. D. Davey, resident engineer; Tom Donald, secretary. Organized Feb. 16, 1895, under name of Northern Territories (B. S. A.) Exploring Co., Ltd., changed June, 1899, to present title, with capitalization £250,000, shares £1 par; issued, £178,000. Debentures, £45,900 outstanding, at 6%; issued 1903, redeemable at £105, December, 1908, and convertible, when fully paid, into £10 shares, on one month's notice, in writing.

Lands, originally were 500 square miles, near the Zambesi river, also 12,000 acres of coal lands and 220 gold claims in the Umniati and Guay districts, but 500 square miles were sold to the Rhodesia Copper Co., leaving 5 blocks of 10 square miles each, on either side of the northern reach of the Kafue river, scattered over an area of 160 miles east and west by 100 miles north and south. Lands include the Silver King, Sable Antelope, North Star, Maurice Gifford, True Blue, Wonder Rocks, Crystal Jacket, Blue Jacket, Bob, Lou-Lou, Sugar Loaf, Lishambika, Inyarka, Kwemba, Hippo, Bwana M'Kubwa and Beehive, in the main concession, also the Chanobi concession of 10 square miles, southeast of the main concession. Of the 11 so-called mines, but 3 are really worthy the name, these being the Chanobi, Silver King and Sable Antelope, the two latter being small, pockety mines.

The principal copper deposits so far located are at and near sundry ancient workings, located in a belt of limestone, about 10 miles wide, running nearly north and south for almost the entire length of the concession. The limestone belt is flanked and sometimes intruded by talcose, quartzose and micaceous schists, and by granite, feldspar and quartz-porphyries, the copper occurring as irregular deposits in limestone, and in veins traversing schists, with oxidation at surface, the predominant ores being tetrahedrite and chalcocite, with occasional bornite and chalcopyrite, the ores in schists being more highly

oxidized than those in limestone. The company has secured ores in greater or less quantities, ranging from 2.5% to 50% copper tenor, and also has ores of lead and zinc, sundry gold claims and a 12" to 24" seam of bituminous coal; with indications of the existence of larger and better grade coal measures.

The company's main camp is at the Silver King mine, in south latitude 14° 36′ 11″ and east longitude 26° 55′, twelve miles south of the northerly reach of the Kafue river. The main shaft is 205′ deep, the ore body, which apparently is a lense, pinching out before the bottom of the shaft was reached, with the possibility that other lenses will follow.

The Chanobi mine, 45 miles from the Silver King, has 5 shafts on 4 separate outcrops. No. 1 shaft is 100′; No. 2 outcrop has a north shaft of 92′ and a south shaft of 98′, latter showing favorable copper values at bottom; No. 3 outcrop has a 78′ shaft showing chalcopyrite and occasional chalcocite; No. 4 outcrop shows copper carbonates on surface. Apparently the various outcrops are of the same small sulphide vein. The Chanobi has a warehouse, and a compound for native workmen.

The Sable Antelope has 3 shafts, showing high-grade chalcopyrite in a vein of 20′ width, on the 50′ level.

The Hippo mine has a 99′ shaft, showing from depth of 34′ to 99′ a good vein of 4′ 8″ average width, assaying 21.36% copper and 2.4 dwts. to 13 dwts. gold per long ton. A second shaft, of 100′, seems not to have developed anything of especial promise.

The Bwana M'Kubwa mine, located circa 90 miles north of the Rhodesia Broken Hill mine, shows 2 parallel veins, traced nearly a half mile, of which one vein, opened by a 150′ shaft, ranges 30″ to 5′ in width, and gives assays of 14.5% to 19.7% copper.

The True Blue mine has steam power and a pump. The Sugar Loaf mine has an immense ore outcrop standing 120′ high, and a tunnel showing a considerable body of low-grade copper ore. No. 3 shaft of the Blue Jacket mine, 138′ deep, shows carbonate copper ores and chalcopyrite.

Transportation to and from the nearest railroad is by traction engines, and the railroad is to reach the Kafue river eventually, and probably will touch the mines. Mr. Davey, in personal charge of the mines, has secured the confidence and good-will of the natives, which counts for much, in the interior of darkest Africa. The management seems good, and some of the copper properties are considered promising, but further extensive development will be required before the company can become a producer, with any reasonable degree of safety, none of the properties having been opened to sufficient depth to assure long life, or the existence of assured tonnage.

NORTHERN TERRITORIES MINES OF AUSTRALIA. AUSTRALIA, LTD.

Offices: Broad Street House, London, E. C., Eng. H. J. Nevill, chairman; T. I. Dyson, manager; H. Simpson, secretary. Organized Jan. 25, 1905, as a reconstruction of Northern Territories Mining & Smelting Co., Ltd., with capitalization £175,000, shares 10s. par; issued, £160,003.

Lands, 604 acres, 113 miles by rail from Port Darwin, in the Northern

Territories of South Australia. Has ores of copper, gold and silver, with a 40-stamp mill at the Howley mine, a 20-stamp mill at Yam Creek and a 20-stamp mill at Brock's Creek. Copper properties are known as the Mount Ellison and Iron Blow mines, former, which is very wet, being opened by a 143′ shaft, giving assays up to 12% copper. The Iron Blow, main shaft 196′, has a mining plant including air-compressor and ore-bins for shipping, also a smelter 1 mile distant, with tramway connecting. The smelter has 2 reverberatory furnaces, and a converter on the ground, but not erected. The smelter, blown in. 1904, in September treated an average of 66 tons of ore daily, producing 204 long tons of matte carrying 61 tons refined copper, circa 17,500 oz. silver and 350 oz. gold. Company and its several predecessors have struggled against financial difficulties from their inception.

NORTHERN TERRITORIES MINING & SMELTING CO., LTD. **AUSTRALIA.**

Succeeded, Jan. 25, 1905, by Northern Territories Mines of Australia, Ltd.

NORTHERN ONTARIO COPPER CO., LTD. **ONTARIO.**

Office: Queen Street, Sault Ste. Marie, Ont. Mine office: Dean Lake, Thompson Twp., Algoma, Ont. Employs 12 men. J. H. Quimby president; A. C. Boyce, M. P., vice-president; Uriah McFadden, secretary and treasurer; John A Montague, general manager Organized January, 17, 1906, under laws of Ontario, with capitalization $500,000 shares $1 par. Lands, 280 acres, lying north of Dean Lake, showing two contact veins, between, slate and pyroxene eruptive rocks, of which one, opened by a 30′ pit, averages 9′ width, showing ore assaying 6.2% copper, 1 oz. silver and $1.20 gold per ton. Has a 65-h. p. steam plant.

NORTHERN SIERRA MADRE MINING CO. **MEXICO.**

Mine office: Suaqui de Batuc, Sahuaripa, Sonora, Mexico. Is said to have two copper properties, known as the Reina de Cobre and Providencia, and a silver-lead mine, known as El Colosus, lying circa 25 miles west of Suaqui de Batuc.

NORTH FORK COPPER MINING CO. **WYOMING.**

Letter returned unclaimed from former mine office, Battle, Wyo.

NORTH MOUNT LYELL COPPER CO., LTD. **TASMANIA.**

Absorbed, 1903, by Mt. Lyell Mining Co., Ltd.

NORTH PACIFIC MINE. **MONTANA.**

Owned by Daly Mining Co.

NORTH PACIFIC MINING CO. **OREGON.**

Office: 29 Hinckley Blk., Seattle, Wash. Property, the Virginia group, in the Cascade Mountains, eastern Oregon, has a 30-stamp mill.

NORTH PLATTE COPPER MINING & SMELTING CO. **WYOMING.**

A swindle, perpetrated by S. F. Pusey of Philadelphia. Lands claimed were in Converse county, Wyoming. Pusey was convicted, on a criminal charge, by the assistance of Prof. H. C. Beeler, State Geologist of Wyoming. James W. King has been appointed receiver for the company, though property scarcely seems worth the trouble of a receivership.

NORTH POLE MINING CO. **COLORADO.**

Office: Aspen, Colo. Mine office: Crystal, Gunnison Co., Colo. Employed 15 men, at last accounts. Jas. T. Stewart, chairman and general manager; Geo. N. Smalley, vice-president; W. Porter Nelson, secretary; Frank Meyer, treasurer; preceding officers, James R. O'Hara, Geo. H. Poor and A. T. Ferris, directors; C. Casagrande, mine superintendent. Organized 1902, under laws of Colorado, with capitalization $500,000, shares $5 par. Lands, 37 claims, area 370 acres, in the Rock Creek district, showing a limestone country rock, carrying 9 fissure veins, of which 3, under development, of 3′ average width, have tunnels of 340′, 680′, 450′, 300′ and 600′, with a total of 3,000′ of openings, estimated to show 100,000 tons of ore, with 50,000 tons blocked out for stoping, ore being chalcopyrite, giving average returns of 8% copper, 1.5% lead, 2% zinc, 8.75 oz. silver and $1 gold per ton. Has a 50-h. p. steam plant, with a 7-drill Rand air-compressor, 15x30′ machine shop, and several other small mine buildings.

NORTHPORT SMELTING & REFINING CO., LTD. **BRITISH COLUMBIA.**

Controlled and operated by Le Roi Mining Co., Ltd.

NORTH QUEENSLAND RAILWAY CO., LTD. **AUSTRALIA.**

Offices: 16, St. Helen's Place, London, E. C., Eng. Organized May 2, 1901, as Normanton-Cloncurry Railway & Copper Mines, Ltd., and name changed to present title July, 1902. Capitalization £50,000, shares £1 par; issued, £33. Property consists of the valuable idea of building a railway, carrying extensive mineral rights, in North Queensland, Australia.

NORTH STAR MINING CO. **MICHIGAN.**

Office and mine: 420 East McLeod Ave., Ironwood, Gogebic Co., Mich. Peter Lofberg, president; Adolf W. Peterson, secretary. Organized May 1, 1903, under laws of Michigan, with capitalization $25,000, shares $25 par. Lands, 240 acres, held under option, showing several cupriferous amygdaloids, on which a 60′ exploring shaft was sunk and crosscuts started. Idle.

NORTH STAR MINING CO. **WASHINGTON.**

Office: 502 Mutual Life Bldg., Seattle, Wash. Mine office: Index, Snohomish Co., Wash. J. F. Ronald, president; J. S. Chase, secretary; Edw. Ellis, general manager. Organized 1901, under laws of Washington, with capitalization $1,500,000, shares $1 par. Lands, 70 claims, area 1,200 acres, lying between the Ethel and Bunker Hill-Sullivan properties, showing a 4′ vein, opened by tunnels of 200′ and 600′, with about 2,000′ of underground openings, said to give average values of 10% copper, from bornite and chalcopyrite. Also holds the Red Mountain group, in Chelan county Washington.

NORTH SHORE COPPER & SMELTING CO. **ONTARIO.**

Apparently fraudulent. Lands were in Aberdeen township, Algoma, Ontario.

NORTH STAR MINING & MILLING CO. **COLORADO.**

Property sold to Silverton Mining Co.

NORTH STATE GOLD & COPPER MINING CO. **NORTH CAROLINA.**

Mine office: Jamestown, Guilford Co., N. C. James Palmer, superin-

tendent, at last accounts. Has a vein of 2′ to 25′ width, carrying auriferous copper sulphides, opened to depth of circa 400′. Has steam and water power, 50-ton concentrator and a mill with 20 gravity stamps.

NORTH VERDE COPPER CO. **ARIZONA.**

Office: 303-167 Dearborn St., Chicago, Ills. Mine office: Jerome, Yavapai Co., Ariz. W. P. Cooper, president; E. C. Weatherley, vice-president; John Tierney, general manager; J. J. O'Donohue, secretary and treasurer; J. F. Mowles, superintendent. Organized January, 1904, under laws of of Arizona, with capitalization $3,000,000, shares $1 par. Lands, 6 claims, area 120 acres, contiguous to the United Verde mine, in the Black Hills district, opened by an 80′ shaft, planned to be sunk to 500′, and a 250′ tunnel, latter showing calcspar, iron and soft rock, in a zone of circa 150′ width, with a little ore carrying about 2.5% copper and 3 oz. silver per ton, with traces of gold. Equipment includes a 40-h. p. Fairbanks-Morse double-cylinder hoist and an air-compressor. Property is considered well located.

NORTHWEST COPPER CO. **BRITISH COLUMBIA.**

Dead. Operated the Van Anda mine, 1901-1902.

NORTHWESTERN CONSOLIDATED LUMBER, OIL & COPPER CO. **OREGON.**

Office: care of Glenn M. Deuell, secretary, Grand Rapids, Mich. Dr. O. A. Lacrone, president and general manager. Lands supposedly in vicinity of Baker City, Oregon. Presumably idle.

NORTHWESTERN COPPER MINING CO. **WYOMING.**

Office: 509 New York Life Bldg., Omaha, Neb. Mine office: Dillon, Carbon Co., Wyo. Chas. R. Courtney, president; W. D. Reed, vice-president; F. E. Brown, secretary and general manager; N. A. Kuhn treasurer; H. H. Roberts, secretary. Organized 1902, under laws of Wyoming, with capitalization $100,000, shares 10 cents par. Lands, 15 claims, area 300 acres, including the Batchelder mine, in the Battle Lake district, lying circa one mile west of the Ferris-Haggarty mine of the Penn-Wyoming Copper Co., carrying about one mile of the strike of a vein of 10′ to 50′ width, apparently a continuation of the Ferris-Haggarty vein, opened by a shaft of circa 100′, showing oxide, carbonate and sulphide ores, mainly the latter, of concentrating grade, assaying 3% to 40% copper and $2 to $20 gold per ton. Mine has circa 1,000′ of workings, and the building of a concentrator is being considered. Property is considered promising.

NORTHWESTERN SMELTING & REFINING CO. **BRITISH COLUMBIA.**

Dead. Smelter sold, 1905, to Britannia Smelting Co., Ltd.

NORTHWEST GOLD & COPPER CO. **OREGON.**

Mine office: Sumpter, Baker Co., Ore. Lands include the Colorado claim, in the Cracker Creek district, said to show a 40′ vein.

NORTHWEST MINING CO. **WASHINGTON.**

Letter returned unclaimed from former mine office, Kettle Falls, Wash.

NORTH WISCONSIN COPPER MINING CO. **WISCONSIN.**

Succeeded, circa 1899, by Chippewa Copper Mining Co.

A. O. NORTON. **QUEBEC.**

Office: 286 Congress St., Boston, Mass. Mine office: Suffield, Sherbrooke Co., Quebec. Lands, 350 acres freehold and 150 acres mining rights, 7 miles from Sherbrooke, with railroads within 2 miles on either side. Property, known as the Suffield and King mines, in Ascot township, has a shaft of 165′, with circa 900′ of workings, on a vein of 8′ to 9′ average width, and a second shaft of 245′ on a vein of 2′ to 20′ width, giving average assays of 6% copper, from nothing to 10% zinc, 10 oz. to 120 oz. silver and $2.50 gold per ton. Equipment includes a prospecting outfit, with 2 hoists, pumps and 3 power drills. Property considered promising.

NORVELL-PICKRELL COPPER MINING CO. **WYOMING.**

Mine office: Encampment, Carbon Co., Wyo. J. S. Norvell, superintendent, at last accounts. Presumably idle.

NORWAY MOUNTAIN GOLD & COPPER MINING CO. **BRITISH COLUMBIA.**

Office: care of Thomas & Co., fiscal agents, 503 Provident Bldg., Philadelphia, Pa. Agents sold stock on guarantee of dividends within one year, claiming to have copper lands in British Columbia. Apparently a deliberate swindle.

NORWEGIAN-AMERICAN COPPER MINING & SMELTING CO. **NORWAY.**

Office: 1618 Milwaukee Ave., Chicago, Ills. Mine offices: 3 Fjordgaden, Trondhjem, Norway, and Goulasjok, Lyngenfjord, Norway. Employs 100 men. Adolph Larson, president; John Iverson, vice-president; Andrew J. Breda, secretary; Hakon Thompson, treasurer; Hans Boholm, general manager; D. Bryn and J. Johansen, superintendents; Harald Bodtker, engineer. Organized April 20, 1905, under laws of South Dakota, with capitalization $1,000,000, shares $1 par; issued, $450,000. Annual meeting, first Monday in April.

Lands, 54 claims, in 5 groups, situated in 4 districts. Formation is much the same at the various properties, country rock being micaceous schists, of lower Silurian age, with eruptive greenstone conformable with the schists, ore bodies occurring as extended lenses, very persistent in strike and depth, on the contact of the schists with metamorphosed olivine gabbro. Ore is cupriferous iron pyrites, carrying 3% to 10% copper and 10% to 30% sulphur, with small gold and silver values.

The principal mines are the Fines and Tingstad, formerly belonging to King Christian Frederik of Denmark, and were worked 1765–1817, being closed down on account of Norway securing her first independence. These mines are circa 60 miles from Trondhjem, and about ½ mile from tidewater, lying in 2 different valleys of about 20 miles length, connecting with the Trondhjemsfjord, giving fine water transportation. The Fines mine is held under a contract, by which it can be bought for $40,000 cash, or the same price in yearly installments, or can be operated on a royalty basis for 90 years. This mine carries a 5′ vein, estimated to show 50,000 tons of ore averaging 6% to 7% copper. The Tingstad mine is held under a similar con-

estimated to show 30,000 to 60,000 tons of ore, with 20,000 tons blocked out for stoping, giving average assays of 9.3% copper, 4 oz. to 10 oz. silver and $2 to $5 gold per ton, from carbonate ores and chalcocite. Property was opened 1857, closed 1860, on account of Indian troubles, and remained idle until taken over, 1904, by present company. Property has a 125-h. p. steam plant at the mine, and a 100-h. p. steam plant at the smelter. Equipment includes 3 hoists, good for 400′ to 600′ depth, and a 2-drill Rand air-compressor, with 15 shops and mine buildings, of wood, sheathed with iron. The smelter, at Calera, receiving ore by wagon from the mine, has a 60-ton water-jacket blast-furnace, turning out black copper of 90% to 95% tenor, with included gold and silver values, shipped to the Nichols Chemical Works for electrolytic refining. Company plans continuous development, on a considerable scale.

OHIO MINE. **ARIZONA.**

Office and mine: care of Louis Krockel, Metcalf, Graham Co., Ariz. A slightly developed property, of some promise, claimed to show 60′ of ore, assaying up to 20% copper.

OHIO MINING & MILLING CO. **COLORADO.**

Mine office: Montezuma, Summit Co., Colo. R. T. Williams, superintendent. Ores carry gold, silver and copper. Has steam power and a small concentrator.

OJANCOS MINING CO. **CHILE.**

Out of business. Lands sold to Copiapó Mining Co., Ltd.

VERWALTUNG DER KONIGLICHE PREUSSISCHEN- UND HERZOGLICHE BRAUNSCHWEIGSCHE KOMMUNION HÜTTEN-STAATSWERKE OKER. **GERMANY.**

Is the smelting plant of the Rammelsberg mine.

O. K. EXTENSION MINING & REDUCTION CO. **UTAH.**

Office: 40 Commercial Blk., Salt Lake City, Utah. Letter returned unclaimed from former mine office, Blue Acre, Beaver Co., Utah. A. J. McMullen, president and general manager; C. C. Gott, secretary and treasurer. Organized November, 1899, under laws of Utah, with capitalization $150,000, shares 50c. par. Lands, 21 claims, area 360 acres, also a 20-acre millsite, near the O. K. mine, in the Beaver Lake district, showing two fissure veins of 5′ average width, carrying chalcopyrite assaying 4% copper and 6 oz. silver per ton, with traces of gold, opened by 6 shafts, deepest 510′, and a 150′ tunnel, with 1,045′ of underground openings. Has steam and gasoline power.

O. K. GOLD & COPPER MINING CO. **ARIZONA.**

Office: Lyndon, Kansas. Mine office: Florence, Pinal Co., Ariz. W. L. Newcomer, president; S. B. Johnson, secretary; J. Banning, treasurer and general manager; Abe Johnson, superintendent. Organized 1902, under laws of Arizona, with capitalization $1,000,000, shares $1 par. Lands, 15 claims, area 300 acres, in the Picacho district, showing numerous veins, of which two, of 3′ average width, are opened by 6 shallow shafts, deepest 120′, and by 4 tunnels, longest 125′, showing oxide, carbonate and sulphide ores, giving assays up to 20% copper, with traces of gold and silver. Idle.

OKLAHOMA MINING & SMELTING CO. **ARIZONA.**

Lands are 25 claims in the Mineral Hill district of Pinal county, Arizona. Henry G. Beard, president; Lee Troxel, superintendent. Is sinking 2 shafts, on the Jennie Captain and Malcolm claims, on a 14′ vein carrying auriferous and argentiferous copper ore.

O. K. MINE. **AUSTRALIA.**

Mine office: Cloncurry, North Queensland, Australia. Allan Gibb, manager. Property shows sulphide copper ores.

OKUZU MINE. **JAPAN.**

Mine office: Okuzu-mura, Kita-Akita-gori, Ugo, Japan. Is a silver mine, near Hanawa, making a trivial amount of copper, as a by-product.

OLALLA COPPER MINING & SMELTING CO. **BRITISH COLUMBIA.**

Office: Second National Bank Bldg., Paterson, N. J. Mine office: Olalla, B. C. Robert Gaede, president; Joseph Bamford, Jr., vice-president; John E. Tylee, secretary and treasurer; A. A. Watson, general manager. Organized October, 1901, under laws of Maine, with capitalization $8,000,000, shares $25 par. Company controls the Similkameen & Keremos Ry. Co., capitalized at $3,000,000. Annual meeting, second Tuesday in November. Lands, circa 50 crown-granted claims, also a 100-acre mill and smelter-site, total area circa 2,500 acres, in the lower Similkameen and Keremos camps, Osoyoos division, Yale district, showing contact veins between diorite and felsite, ore bodies occuring in both formations, but mainly in the felsite. Veins, about a dozen in number, were claimed, by a former management, to range in width from 3′ to 500′ and were estimated to average about 5% copper, 2 oz. to 5 oz. silver and $1 to $40 gold per ton, but this estimate, which was unwarranted, has been revised to reasonable dimensions by the present management, which claims to be developing a vein averaging 7′ width, carrying auriferous chalcopyrite averaging 1% copper and $4 gold per ton. Gangue is spar, garnetite and magnetite. Development includes a 70′ shaft and tunnels of 200′, 200′, and 600′. Property has hand-power only, and is 87 miles from a railroad, 60 miles of which has steamer transportation. Company planned installation of a smelter in 1904, but did not build it. Present management is to be commended for claiming only what it can substantiate.

OLD BALDY GOLD MINING & TUNNEL CO. **NEW MEXICO.**

Mine office: Elizabethtown, Colfax Co., N. M. Thos. C. Sewall, superintendent, at last accounts. Ores carry gold and copper. Has gasoline and electric power.

OLD BALDY MINE. **ARIZONA.**

Letter returned unclaimed from former mine office, Tucson, Ariz.

OLD BOOT MINE. **ARIZONA.**

Owned by Imperial Copper Co.

OLD CATAWBA MINE. **UTAH.**

Office: care of Hon. Theo. Botkin, president and general manager, Salt Lake City, Utah. Property is a group of 7 promising claims, near Milford, Beaver county, Utah. Idle.

OLD COLONY COPPER CO. **MICHIGAN.**

Office: 60 State St., Boston, Mass. Mine office: Calumet, Houghton Co., Mich. Employs 12 to 15 men. H. F. Fay, president; Geo. G. Endicott, secretary and treasurer; James Chynoweth, superintendent; preceding officers, John C. Watson, Wm. Howell Reed, Rogers L. Barstow, and Stephen R. Dow, directors. Organized 1898, under laws of Michigan, with capitalization $2,500,000, shares $25 par, $12 paid in. Annual meeting, second Wednesday in December.

Official returns to the state of Michigan, as of date Jan. 1, 1905, disclose the following figures:

Amount of cash paid in on capital stock	$381,350.00
Amount paid in by conveyance of property	700,000.00
Entire amount invested in real estate	764,304.26
Amount of personal estate	58,162.15
Amount of floating debt	1,955.00
Amount due company	72.50

Lands, 1,200 acres, in Sections 17 and 18, T. 56 N., R. 32 W., east of and adjoining the Calumet & Hecla, from which 40 acres of surface rights, in 18–56–32, were sold, 1905, to the Centennial. A complete geological cross-section was secured, by a tunnel, driven, 1899–1901, from the Eastern Sandstone, 57° west of north, for about 3,000′, at right angles to the formation, which has a strike of No. 33° E., and by diamond drill borings from the Kearsarge amygdaloid eastward to the western end of the tunnel. This work shows upwards of 75 amygdaloidal and conglomerate beds, a number of which gave a little copper in the drill cores. There are 5 shafts, No. 1 being 400′ deep; No. 2, 250′; No. 3, 550′; No. 4, 100′; and No. 5, 200′. In July, 1906, a little chute of copper was found, in the west crosscut on the 700′ level. Results, to date, have been of a discouraging nature.

OLD DOMINION COMPANY. **ARIZONA.**

Office: 99 John St., New York. James Douglas, president, Chas. Sumner Smith, vice-president; Chas. H. Altmiller, secretary and treasurer; preceding officers, Cleveland H. Dodge, J. Waldo Smith, Maxwell Woodhull and C. G. Lund, directors. Organized Dec. 22, 1905, under laws of Maine, with capitalization $8,750,000, shares $25 par; issued, $7,013,025. First dividend, of 50 cents per share, amounting to circa $140,000, was paid December 15, 1905. Is a securities holding corporation only, organized to promote the operation of the mines of the Old Dominion Copper Mining & Smelting Co. and the United Globe Mine, under a joint management, while technically complying with injunctions restraining the merging of these two corporations. Property of the Old Dominion Co. is exclusively shares in the two subsidiary corporations named, and the Old Dominion Co. is controlled by the United Globe Mine, owned by Phelps, Dodge & Co., the United Globe having given 138,000 shares of its stock and $250,000 cash for 138,000 shares of the Old Dominion Co. The Old Dominion Co. has exchanged its stock for shares of the Old Dominion Copper Mining & Smelting Co., and at the annual meeting, February, 1906, held 142,521

shares out of the issued capital of 150,000 shares of the Old Dominion Copper Mining & Smelting Co., and upwards of 95% of the issued stock of the Old Dominion Copper Mining & Smelting Co. is now held by the Old Dominion Co., and control of the latter is held by Phelps, Dodge & Co., through ownership of 150,000 shares of stock of the Old Dominion Co. The United Globe mine and the Old Dominion mine are operated by the Old Dominion Co., as entities, but with free interchange, upon an equitable basis, of ores for smelting and fluxing. The Old Dominion Co. financed the floating indebtedness of the Old Dominion Copper Mining & Smelting Co., by means of a loan, which has been greatly reduced, from net earnings, the balance at the close of 1905 being estimated at $100,000, and this doubtless was paid during the first few months of 1906.

OLD DOMINION COPPER MINING & SMELTING CO. **ARIZONA.**

Office: 852-50 Congress St., Boston, Mass. Mine office: Globe, Gila Co., Ariz. Employs circa 1,000 men. Chas. Sumner Smith, president; preceding officer, Geo. Napier Towle and Dr. Joseph T. Herrick, executive committee; preceding officers, Chas. T. Lund, Fred. W. Hoar, E. F. Newton and G. Waldo Smith, directors; Chas. H. Altmiller, secretary and treasurer; Dr. L. D. Ricketts, consulting engineer and acting manager; Niles S. Berray, general superintendent; Chas. F. Shelby, smelter superintendent; Peter Hutton, assistant smelter superintendent. Organized July, 1895, under laws of New Jersey, with capitalization $5,000,000, shares $10 par: issued, $3,750,000, Annual meeting, first Wednesday in April. The Old Dominion Company, of Maine, controls the Old Dominion Copper Mining & Smelting Co., through ownership of circa 95% of outstanding stock of latter-named corporation. Last dividend was paid 1895, but the Old Dominion Co. is a dividend payer. Had a considerable floating debt, which was taken up by the Old Dominion Co., and which had been reduced to about $100,000, at the close of 1905, and which probably was wiped out during the first few months of 1906. A suit against Messrs. Bigelow and Lewisohn, for an accounting of promotion profits, has been decided against the company.

Lands, 6 full and 3 fractional claims, and a 10-acre millsite, at Globe, also the Old Dominion and Keystone claims, north of Globe, the Geneva mine, the Continental group of 240 acres and the Chicago & New York group of 60 acres, two latter groups being unconnected with the principal tract. The principal ore zone occurs along a displacement having a northeast and southwest strike, with sharp dip to the southeast. The hanging wall is limestone and quartzite, with a footwall of diabase of more recent age. Faulting evidently occurred both before and after the intrusion of the diabase. Ore favors the hanging wall, occurring in lenses parallel to the bedding planes of the limestone and quartzite, the largest lense yet developed being about 60x100x200′ in size. The ores carried comprise a considerable variety of forms, including oxides, carbonates, sulphides and silicates. The oxidized ores are mainly cuprite, associated with a little malachite and chrysocolla, in a gangue of iron oxides and quartz. Sulphides

first appear at a depth of about 350′, the principal sulphide ore being chalcocite, with gangue of iron pyrites and quartz, with a little 3% to 4% chalcopyrite in the lower workings. All ores are more or less argentiferous, and, as a rule, are highly silicious, requiring heavy iron and lime fluxes in smelting.

The Old Dominion has suffered from a lack of sulphide fluxing ore, its own supply being inadequate, and in addition to buying custom sulphide ores, from the small mines of the district, has brought in 100 tons or more daily of sulphide ores from the Bisbee field, and some concentrates from the Moctezuma mine, in the Nacozari district of Sonora, Mexico. A newly discovered sulphide ore body on the 14th level is very low in grade, averaging about 2% copper only, with a paystreak of high-grade ore. This ore is likely to improve in copper tenor at greater depth, but even should it fail to do so, is of decided value, for fluxing purposes, the rich sulphide stopes on the 11th and 12th levels being nearly exhausted. Underground developments for the two past years have been of very a favorable nature. An ore body under Pinal creek, reopened 1905, shows carbonate and oxide ores, running up to 20% copper, on the eighth, ninth and tenth levels, with chalcocite of an even better tenor on the eleventh level.

The old shafts of the mine have suffered severely from crushes and creeping, the mineralized zone being soft, hence the new shafts have been sunk in the footwall. The new main working shaft was bottomed on the twelfth level in 1905, and will be deepened. This has 4 compartments. "C" shaft was 180′ deep in April, 1906, and a third, and possibly a fourth new shaft may be started, before the close of the year. The mine suffered, early in 1906, from both fire and flood, but the fire was mastered quickly, and the flow of water had diminished, by June, to circa 3,500,000 gallons daily. The mine has a pumping capacity of 6,000,000 gallons daily, the largest pumping-engine being a 1,500-gallon Prescott pump, on the tenth level, having a 12″ water-column, discharging 30′ above the collar of the shaft, into a launder on a trestle leading to a storage tank, whence water is drawn for use of the mill and smelter.

The engine-house and boiler-house at the new shaft are of steel frame, with iron sides and roofs. There is a large and well-equipped machine shop, which is an important factor in the success of a mine located some hundreds of miles from a large shop doing all classes of custom work. Machinery equipment includes a 30-drill Nordberg cross-compound air-compressor, with water-jacketed air-cylinders and intercooler, having a capacity of 2,000 cubic feet of free air per minute. There also is a complete electric light plant, and petroleum is used exclusively for fuel, at the power plant.

Ores are graded and furnace charges prepared at the millsite, a short distance from the mine. The grading plant has 6 steel bins, of 85 tons capacity each, for coarse ore, with a conveying belt passing beneath. Ore is drawn from the various pockets onto trammels of manganese steel, undersize dropping to an 18″ conveying belt that carries it to railroad storage-bins, while the oversize goes to a 10x20″ crusher and thence to a 36″

picking-belt, from which the smelting ore is hand-picked and the residue run through a 10x20″ rock-breaker crushing to 2″ size, the material from the last crusher being taken on an 18″ belt to the concentrator storage-bins.

Mill, mine and smelter are connected by a private railway, equipped with a 14x20″ Porter locomotive and 50-ton ore cars.

The 300-ton mill, of steel frame and iron-sheathed, on concrete foundations, was built from the plans of Dr. Ricketts, and went into commission July 30, 1905, and it is planned to increase the capacity to 450 tons during 1906. Equipment includes 18 Frue vanners and 9 Wilfley tables. The plant is absolutely automatic in its handling of material, and is, beyond question, one of the best mills ever built, both in theory and practice, which, in this instance, have been brought into practically perfect correlation.

The old smelting plant has been so thoroughly rebuilt and remodeled that it retains scarcely anything of the old smelter. The main buildings are of steel, on stone foundations. There are 8 double storage-bins, holding 1,000 tons of coke, limestone and ore. There are 4 blast-furnaces, each 44x180″ at the tuyeres, arranged tandem, with common settlers between, charged automatically from side-dumping cars. The furnaces are rated at 400 tons daily capacity each, but are giving a duty in excess of their rating.

The converter department has three stands. Shells are 7x11′, lined with a mixture of clay and quartzite, carrying 4.5% copper, the lining carrying 75% silica and making 18 tons of blister copper before burned out. Available converter blast is 18,000′ per minute. Shells are handled by a 40-ton electric traveling crane. Product of the furnaces is a 50% matte, and of the converter is 99.5% blister copper, carrying small silver values. The converter slag-yard is 18x70′, of concrete, with a floor of 2″ iron plates, laid on brick. The dust-flue chamber is 20x20x250′, connecting with a smoke-stack of 23′ diameter at base and 14′ at top, 200′ high, on a base 25′ above the tuyeres. Flue-dust is briquetted for resmelting, and a second briquetting machine, to be added, will give a daily capacity of 300 tons of fines and dust, and a reverberatory furnace may be built to smelt briquettes.

The power plant at the smelter has two 200-h. p. and two 325-h. p. boilers, burning petroleum. Blowers of 45,000 cubic feet per minute capacity furnish furnace blast, and an electric generator furnishes energy for the crane, lighting and traction, there being an electric locomotive and three 3,000-lb. tilting cars for charging, and a steam locomotive and dump-cars for handling slags. Fuel is largely petroleum, and the company still has trouble in securing an adequate coke supply for the furnaces.

The old slag-dump is estimated to carry nearly 50,000,000 lbs. fine copper, values ranging from 2% to 4% in the more modern slags, made before present management took charge, up to as high as 8% copper in the oldest slags. These slags are being resmelted, gradually, and the recovery to date has averaged about 2% copper.

It is planned to build a model hospital for employes, during 1906, and it is to be presumed that the libraries, gymnasiums and clubs found at other Phelps-Dodge mines will appear at Globe also, in time.

The Old Dominion smelter, in addition to treating Old Dominion and United Globe ores, does a large custom business, handling the ores of a half-dozen local mines, and also treating Moctezuma concentrates and more or less sulphide ore from Bisbee, latter bought for fluxing purposes. The plant is said to be treating nearly 50% custom ores. Production, which was 28,919,217 lbs. fine copper, 1905, was probably circa 16,000,000 lbs. Old Dominion copper, 7,000,000 lbs. United Globe and balance from custom ores. The smelter was producing nearly or quite 3,000,000 lbs. fine copper monthly, at the end of the year, and in May, 1906, was treating circa 40,000 tons monthly and making copper at the rate of about 3,500,000 lbs. per month. For 1904 the production of the Old Dominion mine was 15,368,147 lbs. fine copper, 86,124 oz. fine silver and 1,523, oz. fine gold. Smelter returns, 1903, were 6.54% copper and in 1904 6.41% copper, with slag loss reduced, in latter year, to only 0.48% copper. Copper cost 11.05 cents in 1903 and 11.18 cents in 1904, and should be made for 9 cents per pound, or possibly less, after improvements are completed, as all improvements, even those of a permanent nature, usually charged to "construction account" by mining companies, are charged direct to operating expenses by the Old Dominion. Profits were $142,000 in 1904, or less than one cent per pound of product, but must have been materially larger in 1905.

The management of the Old Dominion is excellent, and while some serious problems have been presented, the greatest of these have been solved and the answers to the others will be forthcoming in time. Dr. Ricketts has done notably good work at the Old Dominion, during the two past years, seconded by the labors of an efficient staff, and backed by the experience, cash and prestige of Phelps, Dodge & Co., which is a name to conjure by, in the southwest. The future of the property appears very bright—a fitting antithesis to a stormy and not altogether happy past.

OLD GLORY COPPER CO. **MONTANA.**

Mine office: Butte, Silver Bow Co., Mont. Organized 1906, under laws of Maine, with capitalization $1,000,000. Property is the Old Glory mine, lying west of and adjoining the Mountain Consolidated mine of the Anaconda, and between the Raven and the Snoozer claims of the Raven Copper Co., opened by a 1,200′ shaft, showing ore carrying small copper values and high gold and silver values on the upper levels, with an increase in copper at depth. Property has been operated since 1885, and since 1903 has raised a little ore, from time to time, through the Buffalo shaft of the Anaconda.

OLD GOVERNORS COPPER MINING & SMELTING CO. NEW MEXICO.

Office: 215½ North Main St., Roswell, N. M. Mine office: San Marcial, Socorro Co., N. M. J. B. Rose, president; Dr. A. J. Ryan, vice-president; M. D. Burns, secretary and treasurer; H. Wallace Stevens, general manager. Organized September, 1903, under laws of New Mexico, with capitalization $1,000,000, shares $1 par; issued, $670,000. Annual meeting, second Tuesday in May.

Lands, 6 claims, area 120 acres, also a 5-acre millsite, in the Dripping

Springs district, 25 miles from the Santa Fé railway, with a good wagon-road connecting, showing fissure veins in porphyry, of which one, of 18′ estimated width, opened by a 30′ shaft and several pits, shows malachite and sulphide ore, assaying 12% copper, 2 oz. silver and $8 gold per ton. Company plans installing a 50-ton concentrator.

OLD HANOVER MINE. NEW MEXICO.

Described under title Hanover Mine.

OLD HICKORY COPPER MINING CO. NEW MEXICO.

Absorbed, circa 1901, by Copper Chief Mining Co.

OLD HICKORY MINE. UTAH.

Owned by Majestic Copper Mining & Smelting Co

OLD NOLL MINE. AUSTRALIA.

Mine office: Leighs Creek, South Australia. E. Bernini, manager, at last accounts. Has steam power and employs circa 20 men.

OLD PUEBLO MINING & MILLING CO. ARIZONA.

Mine office: Tucson, Pima Co., Ariz. Alex. Rossi, president; H. Roche, vice-president; W. R. Haynes, secretary; Dr. H. E. Crepin, general manager. Lands, 9 claims, circa 5 miles west of Tucson, opened by a 70′ shaft, which at a depth of 30′ cut a 15-ton pocket of chalcocite, sampling 33% copper, 16 oz. silver and $2.50 gold per ton.

OLD RELIABLE MINING CO. NEW MEXICO.

Mine office: Golden, Santa Fé Co., N. M. J. B. Mayo, superintendent. Ores carry gold and copper. Has two 5′ Huntington mills.

OLD TIEWAUKEE MINING CO. UTAH.

Office: care of Lewis A. Jeffs, president, Salt Lake City, Utah. Capitalization $500,000, shares $5 par. Lands include the old Tiewaukee mine, area 120 acres, adjoining the Winnimuck, in Salt Lake county, Utah, supposed to carry the Caledonia vein at a depth of circa 600′. Deepest shaft is less than 100′, development being mainly by tunnel, and the property has produced some good ore in the past. Company is said also to own the Yellow Creek property, area 90 acres, near the Hidden Fortune mine, in the Black Hills district of South Dakota.

OLD TOWN MINING & MILLING CO. COLORADO.

Mine office: Russell Gulch, Gilpin Co., Colo. Geo. K. Kimball, Jr., superintendent. Ores carry gold, silver and copper. Main shaft, 900′. Has steam and electric power.

OLYMPIA MINING CO. OF WYOMING. WYOMING.

Office: 187 E. Chicago Ave., Chicago, Ills. Pehr W. Nillson, president; Herman C. Johnson, secretary; John Lundgren, general manager. Lands, supposedly in the Encampment district, Carbon county, Wyoming.

OLYMPIC MINING CO. WASHINGTON.

Office: 301 Lumber Exchange, Seattle, Wash. E. R. Butterworth, president; Alfred Jeffery, secretary. Company advertised stock on the installment plan, claiming that its lands contained gold, copper and coal, but secretary writes, as an excuse for not furnishing a statement, that the company is not developing a copper mine. Regarded with suspicion.

OMAHA COPPER MINING CO.

Office: 1017 New York Life Bldg., Omaha, Neb.

OMAHA GOLD & COPPER MINING & SMELTING CO. **MONTANA.**

Letter returned unclaimed from former mine office, Bigtimber, Mont.

OMAKI MINE. **JAPAN.**

Mine office: Nishitate-mura, Kita-Akita-gori, Ugo, Japan. Mine was opened circa A. D. 1750, and reopened 1885. Ore bodies are lenses in Tertiary tuff and andesite. Largest lense is 70′ deep and 130′ long. Ore is argentite, associated with chalcopyrite, sphalerite and galena. Production, 1896, was 242,690 lbs. fine copper and 858,316 momme fine silver.

OMAR MINING CO. **ALASKA.**

Office: Canterbury Bldg., Portland, Ore. Mine office: Kiam, Alaska. Employs 50 men. Chas. E. Ladd, president; W. A. Howe, vice-president; C. E. S. Wood, secretary and treasurer; S. Peacock, general manager; H. W. Turner, superintendent; John H. Gallagher, assistant superintendent. Organized 1904, under laws of Oregon, and is operated as a close corporation. Lands, 6 claims, area 120 acres, on Prince of Wales Island, 4 miles from tidewater, at an elevation of 3,200′, held on a long lease, from the Khayyam Copper Co. Country rocks are Kasaan greenstone and greenstone schists, latter in part dioritic, showing four parallel ore zones, carrying lenses in schists, these ranging 4′ to 20′ in width and being of unknown length and depth. Development is by tunnels of 140′, 236′ and 650,′ with 1,300′ of underground openings, showing ore giving average assays of 3% copper and occasional zinc, with small gold and silver values. Ore is chiefly chalcopyrite, disseminated through pyrrhotite and marcasite. Equipment includes an aerial tram of 4,186′ and a surface tram of 12,160′, ending at a wharf on McKenzie Inlet. Company planned beginning shipments to Tyee smelter, early in 1906, and shipping circa 20,000 tons of ore averaging 3% copper during the year. Property considered promising.

OMODANI MINE. **JAPAN.**

Owned by Mitsu Bishi Goshi-Kwaisha.

OMORI MINE. **JAPAN.**

Mine office: Omori-mura, Nima-gori, Iwami, Japan. Opened circa A. D. 1300; reopened 1525. Formerly was highly productive, but apparently is nearly worked out. Carries auriferous and argentiferous chalcopyrite in the Eikyu group, and malachite, argentite and native silver in the Hontani group. Production, 1900, was 2,880 momme gold, 122,280 momme silver and 80,139 lbs. fine copper.

ONECO COPPER MINING CO. **MICHIGAN.**

Office: 64-50 State St., Boston, Mass. Mine office: Boston, Houghton Co., Mich. W. F. Fitzgerald, president; S. S. Millet, secretary and treasurer; Joseph Hocking, superintendent. Organized 1899, under laws of Michigan, with capitalization $2,500,000, shares $25 par. Levied an assessment of 50 cents, January 15, 1906. Lands, 800 acres, known originally as the Hungarian mine, and later the Fitzgerald, on which a large amount of exploratory work was done, 1862, and again, 1899-1900. Has one shaft, of circa 500′

depth, with sundry mine buildings and 8 dwellings. Was expected to resume work, eary in 1906, but did not. Fully described in Volume II.

ONEIDA GOLD & COPPER CO. **ARIZONA.**

Letter returned unclaimed from former mine office, Nogales, Ariz.

ONOKO MINES CO. **COLORADO.**

Office: 203 Kittredge Bldg., Denver, Colo. Mine office: Central City, Gilpin Co., Colo. Samuel L. Morris, president; Edgar T. Butler, secretary and treasurer. Organized under laws of Colorado, with capitalization $1,800,000, shares $1 par. Lands, 5 claims, opened by a 229′ vertical shaft, showing a vein with a 12″ paystreak, carrying assay values up to 11.95% copper, 3.91 oz. silver and 0.17 oz. gold. Presumably idle.

ONTARIO & COLORADO GOLD & COPPER MINING CO. **COLORADO, ONTARIO & YUKON.**

Letter returned unclaimed from former office, 610 Majestic Bldg., Detroit, Mich. Mine office: Central City, Gilpin Co., Colo. Dr. J. E. Burgess, president and general manager; Albert H. Roehm, vice-president; Wm. C. Heath, treasurer; C. H. Colburn, secretary and assistant general manager. Capitalization $1,250,000, shares $1 par. Has mining claims in Ontario, Colorado and Yukon, former being 65 acres adjoining the Wilcox property, on Spider Lake, Cowper township, in the Parry Sound district. Colorado property is the O'Neil mine, near Central City, carrying ores of copper, silver, gold and lead, and equipped with steam power.

ONTARIO DEVELOPMENT CO. **ONTARIO.**

Office: care of Frank Howard, Munising, Mich. M. J. Morrisey, secretary and treasurer. Organized under laws of Ontario, with capitalization $150,000. Lands, 320 acres, 40 miles north of Sault Ste. Marie, Ontario, and just north of Goulais Bay, opened by 14 shallow pits, deepest 24′, showing an 8′ vein of ore, with quartz gangue, giving good assays in copper.

ONTARIO GOLD & COPPER MINING CO. **ARIZONA.**

Office: care of A. C. Burmister, manager, Prescott, Ariz.

ONTARIO MINE. **WASHINGTON.**

Mine office: Snohomish, Snohomish Co., Wash. Has a 400′ tunnel, cutting a 12′ vein.

ONTARIO SMELTING CO. **ONTARIO.**

Letter returned unclaimed from former mine office, Massey Station, Algoma, Ont. Lands were said to show auriferous chalcopyrite, assaying 3.5% to 6% copper.

O'OKIEP MINE. **CAPE COLONY.**

Owned by Cape Copper Co., Ltd.

OPAL GOLD MINING CO. **WASHINGTON.**

Mine office: Chesaw, Okanogan Co., Wash. J. P. Blaine, superintendent, at last accounts. Ores carry gold, silver and copper. Has steam power.

OPHIR CONSOLIDATED GOLD & COPPER CO. **ARIZONA.**

Letter returned unclaimed from former mine office, Florence, Pinal Co., Ariz. Lands, 7 claims, in the Twin Buttes district, 15 miles east of Florence and circa 4 miles from the Gila river, said to show a 30′ vein carrying a 4′ pay-

streak showing 15% copper, with fair gold and silver values, on the McKinley claim.

OPHIR CONSOLIDATED MINES CO. **COLORADO.**

Mine offices: Telluride, San Miguel Co., Colo., and Ames, San Miguel Co. Colo. W S. Buckley, manager Ores carry gold, silver, lead and copper, latter secured in small quantities, as a by-product. Has electric power, 50-stamp mill and 100-ton cyanide plant, employing a considerable force.

OPHIR COPPER MINING CO. **MONTANA.**

Office: 404-85 Dearborn St., Chicago, Ills. Mine office: Butte, Silver Bow Co., Mont. Edw Ryan Woodle, president; Samuel W. McMunn, vice-president; Lorene Sheetz, secretary; Matthews S. Bradley, treasurer; Sampson W. Hall, superintendent. Organized July 25, 1902, under laws of South Dakota, with capitalization $1,000,000, shares $1 par, in 550,000 temporary preference shares and 450,000 deferred shares; issued, $520,000. Lands, one patented claim, area 20 acres, in South Butte, showing 3 veins, of 5′, 30′ and 50′ average width, carrying chalcopyrite and bornite, assaying 10% to 38% copper, 29 oz. silver and $2.20 gold per ton, with molybdenite and occasional lead. Has a 256′ working shaft and two 50′ air-shafts, with about 5,000′ of underground openings and 144,000 cubic feet of stoping, from which production, previous to 1893, was 16,700 tons of ore, of $275,000 gross value, giving an average of $16.45 per ton. Principal values are in silver, but copper undoubtedly will predominate at depth, indications in this mine and experience of other mines in the district supporting this hypothesis. Has a 180-h. p. steam plant, with hoist good for 1,000′, a 6-drill Rand air-compressor and a 30x40′ carpenter and machine shop. Idle since 1903. Property considered promising, though small.

OPHIR GOLD & COPPER MINING CO. **MONTANA.**

Office: Spokane, Wash. Property is in the Blackfoot district, near Helena, Lewis & Clark county, Montana. Presumably idle.

OPHIR HILL CONSOLIDATED MINING CO. **UTAH.**

Mine office: Ophir, Tooele Co., Utah. E. W. Clarke, superintendent. Ores carry gold, silver, lead, copper and zinc, with values mainly in silver and lead. Has water, steam and electric power, and a 150-ton concentrator, employing about 100 men. Is controlled by Senator W. A. Clark, of Montana, and is operated as a close corporation, no information being given out, but mine is supposedly profitable.

OPHIR MINE. **MONTANA.**

Sold, March, 1906, to Butte Central Copper Mining & Smelting Co.

OPHIR MINING & DEVELOPING CO. **MONTANA.**

Claimed, in advertisements, to have property in Butte, Montana. Perhaps same as Ophir Copper Mining Co

OPHIR QUEEN MINING CO. **UTAH.**

Office: Cedar River, Mich. Mine office: Ophir, Tooele Co., Utah. Samuel Crawford, secretary, treasurer and general manager. Organized April 19, 1902, under laws of Utah, with capitalization $250,000, shares 25 cents par. Lands, 4 claims, area 53 acres, in the Ophir district, showing a 25′ vein,

giving assays of 12% copper, 10% lead, 2% to 15% zinc, 16 oz. silver and 40 cents gold per ton, opened by a 335′ shaft with two 5x8′ compartments, and 3 tunnels, longest 220′ and 225′. Has a 40-h. p. gasoline hoist, 3-drill Rand air-compressor and power drills. Presumably idle.

OPTIMO GOLD & COPPER MINING CO. **MONTANA.**

Office: Missoula, Mont. Mine office: Saltese, Missoula Co., Mont. C. J. Heidenreich, F. C. Mix and W. H. Yearick, directors. Organized, 1904, under laws of Montana, with capitalization $1,500,000, shares $1 par.

OQUIRRH-BINGHAM COPPER CO. **UTAH & WYOMING.**

Office: 1103-279 Dearborn St., Chicago, Ills. Mine office: Bingham Canyon, Salt Lake Co., Utah. H. A. Brown, superintendent. Organized under laws of Wyoming, with capitalization $1,000,000. Has holdings in the West Mountain district of Utah, where some good copper carbonates were shown in the upper levels, late in 1904. Also has lands in Wyoming.

ORDENAURA MINING CO. **MEXICO.**

Mine office: Velardeña, Durango, Mex. E. K. McCann, manager, at last accounts. Ores carry copper, silver and lead.

OREGON COPPER CO. **OREGON.**

Incorporated February, 1903, by J. F. Culter, et al., of Spokane, Wash. Letter to company, care of Culter, returned unclaimed, from Spokane.

OREGON GOLD & COPPER CO. **OREGON.**

Incorporated August, 1902, by Anthony Mohr, et al., of Sumpter, Ore. Letter to company care of Mohr, returned unclaimed, from Sumpter.

OREGON HOMESTEAD MINING & REDUCTION CO. **OREGON.**

Office: care of C. J. Allen, president, Portland, Ore. Frank B. Roberts, vice-president and general manager; W. T. Perry, secretary and treasurer. Organized, 1904, to take over the Allen copper-gold mine, on Rogue river, 3½ miles south of Galice creek, Josephine county, Oregon, at a reported consideration of $750,000. It is planned to develop power by damming Rogue river, where a considerable water power is available. Presumably idle.

OREGON ORE REDUCTION WORKS.

Dead. Organized, 1900, by Letson Balliet, to build a smelter at Portland, Ore. Promoter got into jail before smelter was built.

OREGON SHORT LINE MINING CO. **NEVADA.**

Mine office: Pioche, Lincoln Co., Nev. E. F. Freudenthal, superintendent. Ores carry copper, silver and lead. Idle at last accounts.

OREGON SMELTING & REFINING CO. **OREGON.**

Office: Postal Telegraph Bldg., New York. Works office: Sumpter, Baker Co., Ore. Employs 60 men. Walter E. Lindsay, president; G. F. Holmes, vice-president; Wm. S. Nichols, secretary; E. J. Lindsay, treasurer; Fred D. Fuller, general manager; preceding officers, Scott German and Jas. H. Caldwell, directors; Chas. Kirchen, superintendent; Chas. Van Amberg, smelter superintendent; John G. Kirchen, mining engineer. Organized March 16, 1902, under laws of Arizona with capitalization $600,000, shares $10 par.

Lands include a 200 acre smelter-site, 640 acres timber lands and 40 acres miscellaneous lands. Company is said to have taken a bond and lease, late in

1905, on an iron-sulphide copper mine, circa 20 miles from Weiser, Washington county, Idaho.

The smelter, at Sumpter, has a 46x88′ furnace building, 46x77′ boiler-house, 33x37′ sampling-mill, 32x66′ briquetting plant, 32x52′ laboratory and 16x86′ ore-bins. Smelter has a 38x148″ Allis-Chalmers furnace, turning out matte averaging 40% copper, 300 oz. silver and $150 gold per ton, sent for refining to the Tacoma Smelting Co., at Tacoma, Washington. Fuel is wood, costing $2.50 per cord, soft coal, costing $8 per ton, and coke, costing $12 per ton. During 1905 the smelter treated 8,798 tons of custom ore, making therefrom 174,458 lbs. fine copper, with considerable gold and silver values.

ORE KNOB MINE. **NORTH CAROLINA.**

Mine office: New River, Ashe Co., N. C. Was opened previous to 1860, and closed 1885. Is said to have yielded net profits of $60,302, in 1874. Has a fissure vein of 6′ to 20′ width, with nearly vertical dip, crossing a formation of micaceous granite and mica-schist, carrying mainly sulphide ores of high average tenor, claimed to average 12% to 20% copper, opened by 11 shafts, deepest 400′. Has a 150-ton smelter, built 1902. Idle.

ORFORD COPPER CO. **NEW JERSEY.**

Office: 43 Exchange Pl., New York. Works office: Constable Hook, N. J. Is controlled by the International Nickel Co. and refines nickel matte and ores from New Caledonia and nickel-copper matte from Canada, in addition to treating copper ores and mattes from the United States, Canada, Mexico and elsewhere. Capacity of plant is about 6,000,000 lbs. copper and 1,000,000 lbs. metallic nickel, monthly. Works are exceptionally well equipped, and company has a deservedly high reputation for metallurgical ability, and the fine quality of its metallic products.

ORIENTAL COPPER CO. **ARIZONA.**

Office: 303 Security Bldg., St. Louis, Mo. Mine office: Cave Creek, Maricopa Co., Ariz. W. G. F. Donald, president; John B. Cabanne, vice-president; F. W. Irland, secretary and treasurer; A. S. Mills, superintendent. Organized 1904, under laws of Arizona, with capitalization $2,000,000, shares $1 par. Lands, 11 claims and a millsite, opened mainly by tunnel, showing ore that has given assays of 8.9% copper and 6.8 oz. silver per ton, with occasional small gold values.

ORIENTAL MINING & MILLING CO. **ARIZONA.**

Office: Jamestown, N. Y. Mine office: Providence, Yavapai Co., Ariz. A. F. Kent, president; W. A. Keeler, secretary; W. A. Kent, assistant treasurer; L. B. Kent, superintendent. Is primarily a gold and silver mine, carrying a small percentage of copper. Has steam power and a 20-stamp mill.

ORIENTE DE THARSIS GROUP. **SPAIN.**

Letter returned unclaimed from former mine office, Alosno, Huelva, Spain. Property is large group of government concessions, including the Huera, showing extensive outcrops, remains of ancient works and some old scoria. Has about 400 metres of underground development, on a 5% ore body of 12½ metres, a 4% ore body of 7 metres and a 3.5% ore body of 5 metres, and a body of cupriferous pyrites has been cut to the northward. Deepest crosscut, about

90 metres below the crest of the hill, is on a level with the Tharsis railway and ore can be shoveled into the railroad ore-cars. Idle.

ORIENT GOLD MINING CO. **WASHINGTON.**

Mine office: Bossburg, Stevens Co., Wash. Ores carry gold and copper. Has steam power. Presumably idle.

ORIGINAL CONSOLIDATED MINING CO. **MONTANA.**

Office and mine: Miner Bldg., Butte, Silver Bow Co., Mont. Employs 750 men. Hon. Wm. A. Clark, president; A. H. Wethey, vice-president and general manager; W. M. Bickford, secretary; Thos. Bryant, superintendent; Jere Rourke, engineer. Organized February 20, 1904, under laws of Washington, with capitalization $10,000,000, shares $100 par, succeeding the Original Mining Co.

Lands include the Original, West Stewart, East Stewart, Dives, Home, Woolman and other adjoining properties, the Original and West Stewart being the principal producers. Mines are connected underground with adjoining properties and use oak guides instead of pine or other soft wood. On the 1,900′ level a 17′ vein with a 6′ paystreak, carrying chalcocite and bornite, assaying up to 42% copper, was cut, early in 1906.

The Original mine has a 2,000′ two-compartment shaft, equipped with a 126′ steel gallows-frame and a 36x72″ Nordberg first-motion duplex hoist, good for 3,000′ depth.

The West Stewart has a 1,900′ vertical shaft, to be sunk to 2,000′, showing at the bottom a 30′ vein said to average 10% copper, with fair silver values, the showing in the lower levels being better than above. The West Stewart has 120′ steel gallows-frame, and a hoist that is a duplicate of that at the Original shaft.

The machinery equipment, in addition to the hoists, includes 4 steam air-compressors and 2 Ingersoll-Sergeant air-compressors driven by two 200-h. p. induction motors.

The ore of the Original company is treated at the Butte Reduction Works, under the same ownership, located circa 1½ miles south of the mine, ore being transported over the line of the Butte Electric Railway Co. Production, 1905, is estimated at 18,000,000 pounds. At the beginning of 1906, the property was said to be producing at the rate of 1,200 tons of 3.5% ore daily. The company has a good management, and despite the comparatively small area of its lands, the mine is a highly productive and very valuable property.

ORIGINAL MINING CO. **MONTANA.**

Succeeded, Feb. 20, 1904, by Original Consolidated Mining Co.

ORIOLE COPPER MINING CO. **WYOMING.**

Office: Douglas, Wyo. Mine office: Clarence, Converse Co., Wyo. Employs 12 men. Hon. C. D. Clark, president; T. H. Howard, vice-president; E. J. Wells, secretary, treasurer and general manager; Chas. J. Wells, superintendent. Organized 1902, under laws of Wyoming, with capitalization, $750,000, shares $1 par. Lands, 4 claims, area 80 acres, in the War Bonnet district, carrying a fissure vein of 8′ width, in granite, opened by shafts of 75′ and 255′,

showing carbonate ore assaying about 6% copper, with traces of gold and silver Has a 40-h. p. steam plant, with hoist and 2-drill Leyner air-compressor. Company plans deepening shaft and crosscutting.

ORION MINING CO. **NEW MEXICO.**

Office: P. O. Box 12, El Paso, Texas. Mine office: Lordsburg, Grant Co., N. M. A. W. Gifford, manager; B. W. Randall, superintendent. Organized 1898, under laws of New Mexico, with capitalization $200,000, shares $1 par. Property is the Dundee mine, in the Shakespeare district, Grant County, New Mexico, having about 1,000′ of underground openings, said to show 10,000 tons of ore, with quartz gangue, carrying $12 to $14 per ton in gold, silver and copper, which must be concentrated to afford a profit. Company also owns the Three Friends, Black Hawk, and Orion Extra properties, in the Jarilla district of Otero county, New Mexico. Presumably idle.

SOCIEDAD MINERA EL ORITO. **CHILE.**

Mine office: El Orito, San Felix Vallenar, Chile. Operates Las Breas mines, opened 1888, and also owns El Carmen mine, 190′ deep, opened in 1857, now idle. Production, shipped as matte, is equivalent to about 1,200,000 lbs. fine copper yearly.

ORKLA GRUBE AKTIEBOLOG. **NORWAY.**

Norwegian title of Orkla Mining Co., Ltd.

ORKLA MINING CO., LTD. **NORWAY.**

Offices: 61, Gracechurch St., London, E. C., Eng. Mine office: Thamshavn, Norway. Thos. Fearnley, chairman; Consul Christian Thams, general manager; preceding officers, P. M. Wikstrom and Thv. Olrog, directors. Organized December 7, 1904, under laws of Norway, under title Orkla Grube Aktiebolog, with capitalization 2,000,000 kronor, shares 5,000 kronor par. Has organized a subsidiary company, for the building of a railroad of 18.5 kilometres, to transport ore from the mines to Thamshavn.

Lands, 2,500 acres, including mining, timber and miscellaneous lands, with a total of 91 claims, in the Meldal and Orkedal valleys, Southern county of Trondhjem. Principal properties are the Lokken, Hoidal and Dragset mines.

The Lokken mine, opened A. D. 1657, has a 200′ upper shaft, a 900′ main shaft and a 900′ tunnel, showing considerable ore bodies.

The Hoidal mine, opened A. D. 1680, includes properties known as the New Hoidal and Old Hoidal, principal openings being tunnels of 200′ and 500′.

The Dragset mine has shafts of 200′ and 300′, and a 100′ tunnel.

The Aamot and Kong Karl mines have 100′ tunnels each, and the Victoria mine, opened circa 1870, also has comparatively slight development. Ore in sight in the mines is estimated at 1,665,000 long tons, ore occurring in lenses of various sizes, as cupriferous pyrites and chalcopyrite, in a brecciated formation of schistose diorite, carrying iron pyrites in the foot, and chalcopyrite in the hanging.

The main dressing plant is at the Lokken mine, and aerial trams are being built from this mill to the other mines, for the transport of ore. The company has its own postoffice and telegraph office, by arrangement with the Norwegian government.

The property has a fine water-power in the Skjaenaldfos waterfall, and has erected at that point a power station, of which 110 h. p., utilized by turbine, will actuate hoists at the Lokken and Hoidal mines. A 2,400-h. p. power station at the Skjaenoldfos waterfall will furnish energy for an electric railroad line of 18.5 kilometres, running from Svorkmo to Thamshavn. This line, now under construction, will carry passengers as well as freight. A second electric railway will be built from Svorkmo to the mill at the Lokken mine, for ore transport only. Thamshavn is on tidewater, at the end of the Orkedalsfjord, which is an arm of the Trondhjemsfjord, and the company is building wharves, at Thamshavn, which will have automatic loading devices for the dispatch of ore. The railroad company will have a steamer, making 2 round trips daily, between Thamshavn and Trondhjem.

Company plans exporting annually, to Great Britain, at least 100,000 tons of pyrites and cupriferous pyrites, and hopes to increase this output materially, in time.

ORO COBRA MINING CO. **ARIZONA.**

Office: 715 High St., Burlington, Iowa. Mine office: Welton, Yuma Co., Ariz. Employs 10 men. Thos. Wilkinson, president and general manager; Hon. John J. Hocking, vice-president; S. M. Wilkinson, secretary; Mark Murphy, superintendent. Organized October, 1901, under laws of Arizona, with capitalization $1,500,000, shares $1 par; issued, $900,000. Annual meeting, second Wednesday in February. Lands 10 claims, area 200 acres, in the Ellsworth district, 15 miles from the Arizona & California railroad, showing country rocks of diorite, granite, and porphyry, carrying several fissure veins in diorite and porphyry, these ranging from a few inches to 20′ in width, showing oxide and carbonate surface ores giving assays of 12% to 15% copper and $1.50 to $80 combined gold and silver values per ton. Development is by shafts of 40′, 40′ and 100′, and by a tunnel of 175′. Company plans continuing development work.

ORO CONSOLIDATED MINING CO. **ARIZONA.**

Office: care of R. M. Reid, secretary, Colorado Springs, Colo. Mine office: Prescott, Yavapai Co., Ariz. H. I. Read, president; O. P. Hopkins, treasurer. Lands, 5 claims, patented, area 100 acres, in the Mineral Point district, 2 to 4 miles from two railroads. Ore values apparently are mainly in gold, and the company claims to have developed 7,000 tons of ore, worth $9 to $100 per ton.

ORO DENORO MINES, LTD. **BRITISH COLUMBIA.**

Succeeded by Denoro Mines, Ltd.

ORO GRANDE MINES CO. **ARIZOAN.**

Letter returned unclaimed from former office, 1034 Park Row Bldg., New York. Mine office: Wickenburg, Maricopa Co., Ariz. Has upwards of 3,300′ of underground openings, showing a large ore body, considerably mixed with country rock. Property is regarded as promising, but management is viewed with suspicion. Idle at last accounts.

FRANCISCO RODRIGUEZ OROZCO y CA. **MEXICO.**

Office and mine: Masapil, Zacatecas, Mexico. Mines are the Todos Santos,

La Nieva y Anexas, developed by a 175′ main shaft, and a 1,000′ main working tunnel. Ores carry copper, lead, silver and gold values, and property has a 75-ton smelter. Employed about 150 men, at last accounts.

ORTEGA MINING CO., S. A. **MEXICO.**

Is the Mexican incorporation of Southwestern Mining Co.

ORTONA MINE. **AUSTRALIA.**

Office: care of A. Linedale, owner, Irvinebank, Queensland, Australia. Mine office: Percyville, Queensland, Australia. Is slightly developed, and presumably idle.

ORVILLE GOLD & COPPER MINE CO. **BRITISH COLUMBIA.**

Mine office: Golden, Kootenay district, B. C. Idle for several years.

OSAKA ELECTROLYTIC REFINING CO. **JAPAN.**

Office and works: Osaka, Japan.

OSARUZAWA MINE. **JAPAN.**

Owned by Mitsu Bishi Goshi-Kwaisha.

OSCEOLA CONSOLIDATED MINING CO. **MICHIGAN.**

Office: 303-199 Washington St., Boston, Mass. Operating office: Houghton, Mich. Mine office: Opechee, Houghton Co., Mich. Albert S. Bigelow, president: Norman W. Haire, vice-president and general manager: Wm. J. Ladd, secretary and treasurer; preceding officers, J. Henry Brooks, Edward S. Grew, Edward R. Hall and W. A. S. Chrimes, directors; Wm. J. Uren, general superintendent; Frank H. Haller, assistant superintendent; A. Lincoln Burgan, mill superintendent; H. B. Claussen, superintendent motive power; Chas. D. Hohl, chief engineer; James P. Richards, chief mining captain; Hugh James, mining captain, Osceola branch; Joseph Biscombe, mining captain, North Kearsarge branch; Frank Landers, mining captain, South Kearsarge branch; John T. Reeder, chief clerk and purchasing agent; Wm. Veale, mine clerk.

Organized 1873, and reincorporated 1903 for period of 30 years, under laws of Michigan, with capitalization $2,500,000, shares $25 par; issued, $2,403,750, leaving 3,850 shares unissued, in the treasury. Annual meeting, second Thursday in March. Stock is listed on the Boston Stock Exchange.

The following table gives comparative figures for calendar years 1903, 1904 and 1905:

	1903.	1904.	1905.
Tons rock stamped	924,400	1,095,520	1,007,200
Pounds mineral obtained	21,904,243	27,457,497	24,354,391
Pounds fine copper obtained	16,059,638	20,472,429	18,938,965
Percentage fine copper in mineral	73.317	74.560	76.200
Pounds fine copper per ton of rock	17.4	18.7	18.8
Cost of fine copper per pound	10.29c	9.96c	10.68c
Balance of assets	$131,559.63	$505,929.40	$867,775.47

Official returns to the state of Michigan, as of date Jan. 1, 1905, disclose the following figures:

Amount of cash paid in on capital stock ..... $ 890,628.78

Amount paid in by conveyance of property	1,609,371.22
Entire amount invested in real estate	1,299,621.47
Amount of personal estate	1,530,505.37
Amount of floating debt	1,024,575.97

Real estate includes 2,120 acres, in 4 separate tracts, also an extensive millsite, in Houghton county, and sundry timber and miscellaneous lands, in Houghton and Keweenaw counties, Michigan. Mines owned are the Osceola, North Kearsarge, South Kearsarge and Tamarack Junior, the latter idle, and the others active producers.

The old Osceola mine was opened in 1873, on the southern extension of the Calumet conglomerate, six shallow shafts being sunk thereon, but this bed proving unremunerative, except under a few acres, it was abandoned, and work was begun on the Osceola amygdaloid, lying parallel with and 730′ east of the Calumet conglomerate. The Osceola mine proper, area 720 acres, lying next south of the Calumet & Hecla, has 6 shafts on the Osceola bed, which has a strike of approximately N. 39° E., shafts being numbered from north to south. Shafts 1 and 2 are permanently abandoned. No. 3, with 3 compartments, circa 3,000′ deep, is idle. No. 4 is 600′ next south, with 3 compartments and about 3,700′ deep, and is idle. There is small likelihood of shafts 3 and 4 being reopened, the ground tributary to them being nearly exhausted, while the good stopes remaining can be reached from No. 5. No. 5, 1,300′ south of No. 3, is 3,900′ deep, cut down and retimbered throughout, in 1903. No. 6, or Opechee shaft, 1,300′ next south, 4,100′ deep, shows some excellent stopes especially in the southern drifts, at the bottom. There is room on the company's tract for one more shaft, south of No. 6, if desired. Shafts 5 and 6 have practically duplicate surface equipments, with Nordberg hoists good for 6,500′ depth. About 60% of the production of the old Osceola is secured from No. 6, and 25 power drills are worked in the two shafts. Crosscuts have been sent to the Calumet conglomerate at various depths, without encouragement, and diamond drilling was done in 1904, to locate and test the Kearsarge amygdaloid, on the Osceola tract, but the results presumably were not of an especially encouraging nature. The mine has a complete power equipment, with shops, mostly of stone, and a large number of dwellings for workmen. Water is pumped from Lake Superior, for use of the mine and employes.

The Tamarack Junior mine, area 120 acres, lying between the Centennial and Calumet & Hecla, has two vertical shafts, on the Calumet conglomerate, No. 2 being 3,360′ deep, with 12 levels opened. Mining was stopped in 1902, and exploratory work was suspended at the end of 1903. Apparently the Tamarack Junior is dead for all time to come, so far, at least, as the conglomerate openings are concerned, with rather poor prospects of finding any other workable cupriferous bed on the tract.

The North Kearsarge mine, area 1,120 acres, lies north of the Wolverine, with which it has underground connections, and with which land has been exchanged to the extent of 13½ acres, this trade permitting each mine to square its boundaries with the strike of the lode. Shafts are numbered from south to north. No. 1 shaft, 4,000′ deep, has a Nordberg hoist good for 6,500′

depth, operating two 6-ton skips in counterbalance. No 2 shaft, abandoned, is 2,400′ deep. No. 3 shaft, lying 1,825′ northeast of No. 1, is 2,769′ deep, developing a large area of good ground, the north drifts showing best, while the Ahmeek developments point to rich ground for the North Kearsarge toward its northern boundary line. There is room at the north for an additional shaft, beyond No. 3. The Kearsarge amygdaloid bed ranges 16′ to 20′ in width in this mine, and has proven very bunchy, the mine having been a disappointment during 1904 and 1905, but showing more encouragement in the early months of 1906. The south levels, approaching the Wolverine boundary, are showing an improvement, and the lower levels to the north are showing a gain over the poor rock above. Concrete probably will be substituted for wood, in shaft timbering.

At No. 1 shaft there is a stone compressor-house and 30-drill compressor. The office building, combination machine and carpenter shop and warehouse, all of wood, are at this shaft. At No. 3 is located a 45-drill compressor, with two-stage air-end and compound steam-end, having 22x48″ and 42x48″ steam cylinders and 40x48″ and 36x48″ water-jacket air-cylinders and vertical intercooler, housed in a 25x55′ stone and brick building, with steel truss roof.

Extensive diamond drilling was done at the North Kearsarge, during 1905, with excellent results, considerable good stamp-rock having been developed in the foot and hanging walls, at points where the main lode was impoverished. Diamond drill boring costs $2 to $3 per foot, as against $6 to $8 per foot for drifting.

The South Kearsarge mine, area 160 acres, lies south of the Wolverine and east of the Centennial. Development was begun September, 1899, and the best stopes are toward the Centennial line, the lode showing about the same width as in the North Kearsarge and Wolverine mines. There are two shafts, 1,100′ apart, ample for all future requirements. No. 1, the northern shaft, is 1,850′ deep, and can be sunk about 3,000′ before reaching the boundary line. Two skips are operated in counterbalance, and the rock-shafthouse is exceptionally large and well equipped, as it also cares for the rock from No. 2 shaft, with which it is connected by a 1,100′ trestle. No. 2 shaft, 1,762′ deep, can be sunk to a depth of circa 2,800′ before reaching the boundary line. The surface equipment of the South Kearsarge is mainly second-hand, but efficient, and ample for all present requirements, including the old hoist from No. 2 North Kearsarge, raising 5-ton skips. The mine has air-compressors of 55 drills aggregate capacity.

New openings, 1905, in the various branches, were 25,845′, and have averaged circa 5 miles yearly, since 1901, the cost of all openings being charged direct to operating expenses, which is the plan that should be followed by all producing mines. There is comparatively little rock selection, the amount rejected having been about 9% in 1904 and 12% in 1905. It is proposed to change the mining policy so that waste rock will not be hoisted, the culls remaining underground and being used for filling, as at the Baltic mine. The matter of power haulage is being given consideration also.

The Osceola has two stamp-mills, on the shore of Torch Lake, adjoining those of the Tamarack. The old wooden mill, built 1886, was torn down in 1905, its equipment being hopelessly antiquated. The second mill, completed 1899, is 135x215′, and had three stamps with 20″ pistons and 24″ stroke, supplied with circular shoes and striking 100 blows per minute, at 95 lbs. steam pressure, which stamped above 550 tons each, in a day, on test runs. The screens are circular, with ⅜″ openings, allowing easy discharge of coarse copper. The third mill, completed 1902, standing in line with the other, is of steel, 176x213′, and had 4 Nordberg heads of the 4-valve type, with 20x24″ cylinders and circular mortars having ⅜″ screens and hydraulic separators. About 20% of the copper secured in milling comes from the separators and the mortar discharges. The compounding of a stamp, by superimposing the low-pressure cylinder above the high-pressure cylinder, was first suggested by Mr. A. L. Burgan, mill superintendent of the Osceola, and the idea was carried into execution by Mr. B. V. Nordberg. The experimental head compounded in this manner, known as the steeple-compound, gave such satisfactory results that all 8 heads in the two Osceola mills have been compounded. In these heads the low-pressure cylinder gives power on the down-strokes only, while the superimposed high-pressure cylinder is double-acting and raises the piston, as well as aiding in forcing it down.

The compounding of the heads necessitated a considerable increase in wash-room at the mills, the compounded heads treating circa 30% more rock than before, as single-stage stamps. The equipment in the wash department includes 110 Hodge jigs, having quick eccentric return motion, with 6 round tables and one Wilfley table for each stamp, the latter taking headings from the round tables, also an Allis-Chalmers Chilean mill for regrinding. For reducing oversize material from the mortars of the stamps, crushing rolls with fixed bearings were introduced, this also being an idea original with Mr. Burgan, and which is working well in practice. Boilers now work under a pressure of 150 lbs. per square inch and as a consequence of the various improvements adopted, the cost of stamping at the Osceola mills, for 1905, was only 16.95 cents per ton of 2,000 pounds—so far as known, the cheapest milling cost ever secured at any mine crushing rock.

The 43x150′ steel boiler-house, adjoining the mills and furnishing power for both, has three 72″ 250-h. p. boilers delivering steam at 150 lbs. pressure, and nine 84″ 250-h. p. boilers operated under 105 lbs. pressure, all of the locomotive firebox type. Coal is brought to a 500-ton bin over a trestle, in railroad cars. An automatic ash-discharge washes ashes through a launder by water flushed from a stand-pipe at intervals of 3 minutes. Draft is furnished by a 150′ brick-lined self-supporting steel stack. An Allis-Chalmers Corliss engine runs a 100-kw. Morgan-Gardner direct-current generator, operating incandescent and enclosed arc lamps at 220 volts.

The joint pump-house of the Osceola and Tamarack mines, of steel, 35x70′ in size, houses two 40,000,000-gallon triple-expansion Nordberg pumps having 22″, 40″ and 60″ cylinders, with three 30″ horizontal plungers of 52″ stroke and 42″ discharge. Water is secured through an 8′ tunnel, running 1,275′ under Torch

Lake, drawing water through 3″ intake holes, these guarding against clogging by ice. Rock is hauled from mine to mill by the Hancock & Calumet railroad.

Production of fine copper was 20,472,429 lbs. in 1904 and 18,938,965 lbs. in 1905, the decrease being caused by a combination of fortuitous circumstances, including a serious dynamite explosion in the North Kearsarge, strikes, and a lessened percentage of copper in the North Kearsarge rock. For 1906 a larger production should be secured. Dividends, suspended during 1902-1903, were $2 in 1904, and $6 in 1905, while the first semi-annual dividend of 1906, paid July 27, was $6, foreshadowing $12 profit disbursements for the year. The Osceola Consolidated is a large and valuable property, and while results in the past have not been secured as quickly as hoped by shareholders, the profits now being earned are much the largest in the history of the company, and with the anticipated betterment in the North Kearsarge, the efficient work now in progress will yield a full measure of financial reward.

OSCEOLA GOLD & COPPER MINING CO. **WYOMING.**

Property sold, circa 1902, to North American Copper Co.

OSCEOLA JUNIOR MINING CO. **WYOMING.**

Office: Rawlins, Wyo. Mine office: Dillon, Carbon Co., Wyo. J. M. Rumsey, secretary; A. L. Clendennin, superintendent. Lands, near the Ferris-Haggarty mine, have an old 120′ tunnel, and work was resumed, and a new tunnel started, February, 1906.

OSCURO COPPER CO.

Office: care of H. A. Rideout, Wollaston, Mass. Organized March, 1903, with capitalization $250,000.

OSE MINE. **JAPAN.**

Mine office: Ose-mura, Kita-gori, Iyo, Japan. Ore occurs in lenses, largest 230′ long, 100′ wide and 43′ deep, carrying chalcopyrite averaging 3% to 4% copper. Production, 1900, was 9,426 lbs. fine copper.

OSHKOSH-WYOMING MINING CO. **WYOMING.**

Office: 365 Tenth St., Oshkosh, Wis. Mine office: Dillon, Carbon Co., Wyo. O. A. Koch, president; E. E. Mullins, vice-president; H. O. Granberg, secretary, treasurer and general manager; Frank Earle, consulting engineer. Organized June 20, 1904, under laws of Wyoming, with capitalization $1,000,000, shares $1 par; issued, $215,000. Lands, 11 claims, area 225 acres, in the Battle Lake district, showing country rocks of quartzite and gabbro, carrying 4 fissure veins in gabbro, of 22′ estimated average width, opened by shafts of 32′ and 72′ and a 22′ tunnel, showing malachite, azurite and chalcopyrite, estimate to carry average values of 18% copper.

LOS OSOS MINE. **CALIFORNIA.**

Office: care of J. M. Gleaves Estate, owner, San Francisco, Cal. Mine, near San Luis Obispo, San Luis Obispo county, California, is opened on a fissure vein, carrying copper ore with porphyritic gangue, traversing sandstone and shales. Idle since circa 1865.

OTAVI MINES & RAILWAY CO. **GERMAN SOUTHWEST AFRICA.**

English title of Otavi Minen- und Eisenbahn-Gesellschaft.

OTAVI MINEN- UND EISENBAHN-GESELLSCHAFT. **GERMAN SOUTHWEST AFRICA.**

Offices: 14, Behrenstrasse, Berlin, W. Germany. Mine office: Swakopmund, German Southwest Africa. A. Schoeller, chairman; Dr. P. D. Fisher, vice-chairman; A. Gaedertz, general manager; F. Müller von der Werra and Dr. P. Gloner, assistant general managers; Dr. P. Schwabach, general counsel; Th. Gathmann, mine superintendent; Tob. Toennesen, engineer in charge of railway. Organized 1900, under laws of Germany, with capitalization 20,000,000 marks, shares 100 marks par, in 20 series of 10,000 shares each.

Lands, 500 square miles, freehold, including the Otavi and Tsumeb copper mines, in Ovamboland. Latter has been developed largely and can begin production upon a considerable scale, when given rail facilities and a smelter. A railroad line of 570 kilometres is now being built from Alexandre, Portuguese Southwest Africa, to the mines, by the firm of Arthur Köppel, at an approximate cost of $4,500,000, and should be completed before the end of 1907. The mines are decidedly promising, and the company is financially strong, and managed by experienced men.

OTTUMWA COPPER CO. **WYOMING.**

Office: Laramie, Wyo. Mine office: Holmes, Albany Co., Wyo. C. B. Richey, president; W. B. Russey, secretary and treasurer. Lands are the Ottumwa group of claims, about 6 miles southeast of the Rambler mine and 9 miles from Holmes. Development is by a 280′ tunnel, not yet to the vein, which carries ore of concentrating grade.

OUED-MOUGRAS COPPER & IRON CO., LTD. **ALGERIA.**

Offices: 135, Wellington St., Glasgow, Scotland. J. A. French, secretary. Organized Oct. 9, 1903, with capitalization £12,500, shares £1 par; issued, £4,811. Organized to carry on mining in Algeria, or elsewhere.

COMPAÑIA MINERA LAS OURAS. **MEXICO.**

Mine office: Tepezalá, Aguascalientes, Mex. Gabriel Chaves, superintendent. Has copper and silver ores.

OURAY CHIEF MINING CO. **COLORADO.**

Office: Youngstown, Ohio. Mine office: Ouray, Ouray Co., Colo. W. D. Euwer, president; John Beil, secretary; David Ward, superintendent. Ores carry gold, silver and copper. Has gasoline power.

SUCESIÓN RAMÓN F. OVALLE. **CHILE.**

Mine office: Carrizal Alto, Freirina, Atacama, Chile. Operates the Canto del Agua mine, opened 1870, also the Santa Margarita mine, 700′ deep, and about a dozen smaller properties. Production, in form of matte when exported, averages circa 1,250,000 lbs. fine copper yearly.

OVERFLOW MINES (NO LIABILITY.) **AUSTRALIA.**

Offices: 18, Bridge St., Sydney, N. S. W., Australia, Mine office: Bobadah, N. S. W., Australia. T. H. Palmer, manager. Ores carry gold, silver, lead and copper. Has a Ball mill, 40-ton cyanide plant and 50-ton smelter. Employed about 150 men, at last accounts.

ing development work and preparing the property for a daily production of 500 tons of ore. The cost of the railroad is estimated at $300,000, including a light equipment, and the company reports that financial arrangements for building the line were practically completed, early in 1906. The property has been favorably reported upon by Dr. Pratt, an authority of deservedly high standing, and the management of the mine seems conservative and businesslike.

PACIFIC CONSOLIDATED MINING & SMELTING CO. **UTAH.**

Office: care of Willard F. Snyder, president, Salt Lake City, Utah. C. O. Ellingwood, secretary and treasurer. Organized October, 1902, with capitalization $1,500,000, shares $5 par, to develop the Amy and Baltimore groups of 29 claims, in the Merrimac district of Utah. Presumably idle.

PACIFIC COPPER CO. **MICHIGAN.**

Office: 303-199 Washington St., Boston, Mass. Mine office: Houghton, Houghton Co., Mich. Albert S. Bigelow, president; Arthur G. Stanwood, treasurer. Organized August, 1890, under laws of Michigan, with capitalization $1,000,000, shares $25 par; paid in, $2. Ended 1905 with cash on hand, $922.55. Lands, 960 acres, just northwest of the Atlantic mine, supposed to carry the northern extension of the Atlantic ashbed, on which a little work was done, previous to organization of the company in 1890, since which time the property has been idle.

PACIFIC GOLD & COPPER CO.

No definite information obtainable. President's office said to to be "in the saddle," hence it is to be presumed that the secretary's office is "under his hat."

PACIFIC GOLD & COPPER MINING CO. **MEXICO.**

Office: 308 East Ninth St., Kansas City, Mo. J. J. Myers, president; D. C. Rhodes, secretary. Organized under laws of South Dakota, to develop extensive mineral holdings in the Taviche district of Oaxaca, Mexico.

PACIFIC MINING & DEVELOPMENT CO. **OREGON.**

Dead. Lands sold

PACIFIC MINING & METALS CO. **ARIZONA.**

Office: 213 Kittredge Bldg., Denver, Colo. Letter returned unclaimed from former mine office, Tucson, Pima Co., Ariz. John Russell, president; F. A. Hunt, secretary; John D. Coplen, treasurer and general manager. Organized January 7, 1903, under laws of Arizona, with capitalization $10,000,000, shares $1 par. Lands, 30 claims, in two groups, with miscellaneous holdings giving a total area of 760 acres. The north group is on Pinto Creek, 20 miles west of Globe, Gila county, and the south group in the Cañada del Oro district of Pinal county, former group showing country rocks of schists and porphyry, and south group showing granite-porphyry country rock. South group is said to average 5% copper from carbonate, oxide and sulphide ores. The north group has 3,309′ of underground openings, and the south group 550′, claimed by company to show 2,000,000 tons of ore. The Globe property is regarded as one of considerable promise. Presumably idle.

PACIFIC SMELTING CO., LTD. **CHILE.**

Office: 32, Great George St., Westminster, London, S. W., Eng. Mine office: Taltal, Antofagasta, Atacama, Chile. Employs 160 men. Geo. A. Watson, chairman; preceding officer, F. S. Bishop, J. H. Collins, H. F. Collins and H. Fisher, directors; J. H. Melrose, secretary; Alfred Radcliffe, general manager; Samuel Jenkin, mine captain. Organized July 29, 1902, as successor of the Smelting Corporation, Ltd., with capitalization £100,000, shares £1 par; issued, £25,107. Debentures, £240,000 authorized and £3,000 issued, at 5%, which were retired, 1905.

Lands, sundry mining claims, in the Canchas district, 30 miles from Taltal, carrying a fissure vein of circa 40″ width, showing carbonate copper ores, with ferruginous gangue. Mining operations are as yet in an inital stage. The smelter, at Taltal, was blown in March, 1904, but as yet treats custom ores only. Smelter is served by the Taltal railway, a spur of which enters the works, while the main line is not far distant from the mine. Smelter has revolving calciners, 3 reverberatory furnaces and an 80-ton blast-furnace. Monthly production is circa 250 tons of matte, of about 55% copper tenor, and output of fine copper for 1905 is estimated at 3,700,000 pounds.

PACIFIC STEEL CO. **BRITISH COLUMBIA.**

Letter returned unclaimed from former mine office, Alberni, Vancouver Isld., B. C.

PAGOEAT COPPER CO. **CELEBES.**

Holds sundry copper claims in the Pagoeat district, on the northern part of the island of Celebes, Dutch East Indies. Company is composed of men connected with a prominent steamship line of Amsterdam, Holland. Lands show numerous veins, ranging 4′ to 5′ in width, carrying carbonate ores, chalcocite and chalcopyrite, in quartz gangue, of average assay tenor of about 10% copper, with small gold and silver values. Management is composed of excellent people, who lack mining experience. Was developing, at last accounts.

PAHAQUARRY COPPER CO. **NEW JERSEY.**

Office: Bangor, Pa. Lands are mineral rights to 1,028 acres, in Pahaquarry township, Warren county, New Jersey, formerly worked as a copper mine, showing low-grade ores in the old workings. Company was said, March, 1906, to have placed an order with the Colorado Iron Works Co. for milling machinery, including 2 sets of 16x30″ Standard rolls, 4 sets of 10x30″ Standard rolls, and 22 impact screens. Is said to have a 200-ton concentrator, but probably mill is of smaller capacity.

PALACE GOLD & COPPER CO. **ARIZONA.**

Office: 1104 D. S. Morgan Bldg., Buffalo, N. Y. Mine office: Wickenburg, Maricopa Co., Ariz. Geo. A. Sanborn, president; C. M. Clark, vice-president and general manager; M. W. Fuller, secretary; Dr. C. H. W. Auel, treasurer; D. Ainsworth, engineer. Organized Nov. 10, 1902, under laws of Arizona, with capitalization $3,000,000, shares $1 par. Lands, 23 claims, in three groups. The Union mine, apparently one claim only, in the Winifred district, has a 400′ main shaft, with about 2,200′ of underground open-

ings, claimed to show good values in gold, silver and copper. The Ainsworth group, 8 miles southeast of Wickenburg, has 4 prospect shafts, deepest 40'. The third group, known as the Tip Top, is in the Bradshaw Mountains.

The methods of promotion followed in placing the stock of this company are self-condemnatory, and would damn any set of directors, no matter whom they might be. Stock, all common, is sold at three prices, viz., 25 cents, 50 cents, and one dollar per share. The man who buys for 25 cents gets just shares, the man who buys for 50 cents gets a partial guarantee, and the man who buys for a dollar gets a guarantee of 3½% annually, for 20 years, which is 70 cents on the dollar, leaving him out the use of 75 cents for an average term of ten years, and paying 5 cents per share more than his neighbor, at the outset. Any "guaranteed" mining stock is a delusion and a snare. Either the guarantee is worthless, or the "sucker" who buys it pays cash in advance, not only for every cent guaranteed him, but also for the cost of guaranty, cost of promotion and the salary and expenses of whoever may be working the game.

PALM DEVELOPMENT CO. **CALIFORNIA.**

Office: care of E. M. Ross, Los Angeles, Cal. Lands, 23 miles northeast of Acton, Los Angeles county, California, show auriferous and argentiferous malachite, occurring as replacements in a porphyritic dike averaging 180' width, traceable 1½ miles. Has three shafts, deepest 125'. Had a leaching plant, but water supply gave out. Idle for several years.

PALMER MOUNTAIN COPPER MINING & MILLING CO. **WASHINGTON.**

Office; Spokane, Wash. Mine office: Loomis, Okanogan Co., Wash. Organized under laws of Washington, with capitalization $1,500,000. Lands, sundry claims, on Palmer Mountain.

PALOMA MINING CO. **MEXICO.**

Letter returned unclaimed from former office, Springfield, Ills. Mine office: Ayutla, Jalisco, Mexico. Lands include La Puerta, La Falda, La Chapuza and La Providencia mines, in the vicinity of San Antonio de Las Morán. Mine is said to have a 25-ton experimental mill.

PAN-AMERICAN EXPLORATION CO. **MEXICO.**

Succeeded by Cacoma Mines & Smelter Co.

PAN-AMERICAN MINES CO. **MEXICO.**

Presumably dead. Letters returned from former office and mine office.

PAN-AMERICAN MINING & SMELTING CO. **ARIZONA & MEXICO.**

Office: 905–11 Broadway, New York. Mine offices: Prescott, Yavapai Co., Ariz., and Maguarachic, Chihuahua, Mexico. A. Howard Skinner, president; Harry F. Lindsley, secretary and treasurer; Bowling Green Trust Co., New York, registrar. Organized under laws of Arizona, with capitalization $15,000,000, shares $5 par, in $3,000,000 preferred 7% stock and $12,000,000 common stock.

This company was promoted by the notorious Dr. R. C. Flower, who was successful in swindling many unsuspecting American investors, and who, at last accounts, was supposed to be traveling in Mexico, in various

disguises, and hitting the high spots only. The company was also assisted in securing the Quebradillas mine, of Parral, by Grant G. Gillett, the cattle plunger, who left Kansas City between two suns, leaving also a large number of creditors. That preeminent firm of mining swindlers, L. E. Pike & Co., of 294 Washington St., Boston, Mass., also aided in the promotion. The company succeeded the Lone Pine Mining Co., alias the Arizona, Eastern & Montana Smelting & Ore Purchasing Co., of most unsavory memory, succeeding the Buenos Aires Mining Co., Urique Gold Mining Co., Sunset Mining Co. and La Paz Mining Co., which may or may not have had ore of payable grade. Several mines were abandoned, without taking final titles. The Quebradillas mine, of Parral, was optioned by Gillett, but the bond was allowed to lapse. The various Mexican holdings of the Pan-American company, some of which may or may not still be held, included the Recompensa group, at Maguarachic, the Hernandez group at Miñaca, and La Liga and Santa Camilla mines, at Concepción, all of Chihuahua, Mexico, also the Ambidexter group, in Arizona, located circa 1900, on which no ore was found.

PANTEIDAL COPPER CO., LTD. **WALES.**

Offices: 21, Lawrence Lane, London, E. C., Eng. G. Thompson, secretary. Organized Nov. 15, 1898, with capitalization £25,000, shares £1 par: issued, £16,007. Property is mineral rights to two farms, in Merionethshire, Wales. Inactive for some years.

PANUCO COPPER CO., LTD. **MEXICO.**

Lands sold, circa 1905, to Continental Copper Co. Described in Vol. V.

PANULCILLO COPPER CO. **CHILE.**

Succeeded, 1898, by Central Chili Copper Co., Ltd.

PAPAGO MINING CO. **ARIZONA.**

Letter returned unclaimed from former mine office, Aztec, Arizona.

PAPOVSKI MINE. **SIBERIA.**

Office and mine: Semipalatinsk, Siberia. Owned and operated by Papov's Successors. Production, 1899, was 129,497 lbs. fine copper.

PARADISE DEVELOPMENT CO. **ARIZONA.**

Office: care of F. B. Dorr, secretary, and treasurer Douglas, Ariz. Mine office. Paradise, Cochise Co., Ariz. E. C. Huxtable, president; J. L. Andrews, vice-president; S. S. Badger, consulting engineer; preceding officers and R. A. Hall, directors. Lands, known as the Morning Star group, lying west of the Cochise Consolidated Copper Co., in the Chiracahua Mountain, have a 90′ tunnel, showing a little carbonate and sulphide ores, giving assays as high as $40 per ton, in combined copper, silver and gold values.

PARADOX COPPER-GOLD MINING CO. **COLORADO.**

Absorbed, 1903, by San Juan Smelting & Refining Co.

PARADOX MINING & MILLING CO.

Office: Grand Junction, Colo. Mine office: Paradox, Montrose Co., Colo. Employs 6 men. J. A. McCulloch, president; T. W. James, vice-president; A. A. Miller, secretary and general manager; D. T. Stone, treasurer. Organized January 25, 1905, under laws of Colorado, with capital-

ization $1,500,000, shares $1 par; issued, $877,300. Lands, 12 claims, area circa 110 acres, also a 5-acre millsite, in the La Sal and Paradox districts, showing country rocks of limestone, sandstone, shales and quartzite, with intrusive porphyry, carrying 3 fissure and contact veins of 2′ to 7′ width, opened by tunnels of 85′, 100′, 200′ and 400′, showing melaconite and argentite, giving assay values of 3% to 75% copper, and 1 oz. to 1,000 oz. silver per ton, with a trace of gold. Property is 65 miles from a railroad, and is reached by a good wagon-road. Company plans continuing development.

PARAMATTA COPPER MINES, LTD. **AUSTRALIA.**

Offices: 22, Chancery Lane, London, E. C., Eng., and 29, bis, Rue Nationale, Lille, France. Mine offices: Wallaroo, Daly Co., and North Yelta, Daly Co., South Australia. E. Dervaux, chairman; L. G. Hancock, mine manager; H. Duquesne, secretary. Organized May 18, 1899, with capitalization £200,000, shares £1 par; issued, £198,500. Debentures, £20,000 authorized, £9,300 issued, at 5%. Lands, 1,340 acres, held on 99-year lease, at annual rental of $1 per acre, plus 2½% net profits. Property includes the Paramatta, Yelta, Wheal Hughes, and Wheal James mines. The Paramatta, adjoining the Wallaroo mines of the Wallaroo & Moonta, is an old and important producer, reopened, 1900, by present owners. Deepest shaft is 500′, bottomed in a vein ranging up to 8′ width, with richest portions carrying up to 25% copper, and having about 50,000 tons of ore reserves. The Paramatta has been given a modern hoisting and dressing plant, concentrator being of 200 tons daily capacity, and smelter of the same size. The Yelta mine, taken over, 1903, from the New Yelta Copper Mining & Smelting Co., Ltd., is being reopened on a fair scale, and equipped with modern machinery. Production, 1903, was 20,646 long tons of ore, yielding a profit of £8,965. Company paid 25% dividends in 1903, and 5% dividends in 1904.

PARINGA COPPER MINES, LTD. **AUSTRALIA.**

Letter returned unclaimed from former office, 34, St. Mary Axe, London, E. C., Eng. Mine office: Callington, Adelaide, South Australia. W. Davis, manager, at last accounts. Capitalization, £200,000. Lands, 172 acres, 36 miles from Adelaide.

PARK CITY MAJESTIC MINING CO. **UTAH.**

Presumably dead. Was organized on a bond and lease. Present whereabouts of S. T. Rolph, the promoter, are unknown.

PARK GOLD & COPPER MINING CO. **IDAHO.**

Mine office: Mullan, Shoshone Co., Idaho. Thos. F. Kelly, principal shareholder. Patrick Burke, manager. Has 2 tunnels, lower, 1,000′ long, mainly on a vein, said to be 20′ wide, giving a good showing of native copper.

COMPAÑIA EXPLOTADORA DE PARRAL. **MEXICO.**

Mine office: San Bartolo, Durango, Mexico. Property includes El Lentisco mine, carrying auriferous copper ores. Employed circa 40 men, at last accounts.

PARRAL SMELTING CO. **MEXICO.**

Office: care of Samuel Garrison, president, Pittsburg, Pa. Works

office: Parral, Chih., Mex. D. M. Evans, general manager. Capitalization, $1,000,000, Property is a smelting concession, from the State of Chihuahua, and it is planned to build a 250-ton smelter, with both lead and copper stacks.

PARROT SILVER & COPPER CO. **MONTANA.**

Office: 42 Broadway, New York. Mine office: Butte, Silver Bow Co., Mont. Employs about 400 men. Chas. H. Dickey, president; Chas. D. Burrage, secretary; John D. Ryan, managing director; preceding officers, Richard D. Willard, Edw. G. Storey, A. W. Bemis and Sidney Chase, directors; Harry A. Galway, superintendent. Organized 1880, under laws of Montana, with capitalization $2,300,000, shares $10 par; issued, $2,298,500. Is controlled, through ownership of majority of stock, by the Amalgamated Copper Co. Paid dividends, to end of 1905, of $6,347,560. Paid quarterly dividends of 50 cents per share during 1905, but dividend rate was reduced, 1906.

Lands, 19 claims, mainly fractional, area 40.6 acres, well located, in the central portion of the Butte district. The Parrot was opened 1884, and is one of the pioneer mines of the camp. A barren zone occurs at a depth of about 1,000′, but good ore bodies are found below. The ore averages about 3.5% copper and carries fair silver and gold values. Properties operated are the Parrot, Little Minah, Bellona, and Original No. 6 mines. The Little Minah has a 1,000′ two-compartment shaft and is connected underground with the Nipper. The main shaft of the Parrot, 1,900′ deep, has three compartments to the 4th level and 4 compartments below, being connected underground with the Colusa-Parrot, Never Sweat, Nipper and Original No. 6 mines. The shaft was retimbered, 1904, and the mine is timbered with 10x10″ square and round timbers, and has electric call-bells. In May, 1906, the bottom level showed a 30′ vein, apparently a continuation of the Anaconda vein, carrying high-grade chalcocite and bornite. The shaft has a 112′ steel gallows-frame, weighing 125 tons, with a maximum load capacity of 50 tons. The Parrot shaft has a Union Iron Works hoist, with 28x96″ cylinders, capable of raising 10-ton loads from a depth of 3,000′, hoisting two double-deck cages with 10-ton skips swung under, using a flat steel rope ⅝″ thick and 8″ wide. Machinery plant includes an 80-drill Ingersoll-Sergeant air-compressor and a 22-drill Rand compressor. Mine buildings are mainly of steel, stone and brick, these including an engine-house, boiler-house, compressor-house, various shops and a model two-story changing-house with cement floors, 24 shower-baths, and lockers for 350 men. The mine has an antiquated smelter, idle since 1900, ores being reduced at the Washoe plant of the Anaconda. Company also owns copper refining works at Bridgeport, Conn., these also being antiquated and idle.

Production is not made public, but is estimated at 9,000,000 lbs. fine copper only for 1905, but should be larger for 1906. The settlement of the Amalgamated-Heinze litigation places the Parrot in a much better position than formerly, and, barring misfortunes, the mine should make nearly 12,000,000 lbs. fine copper during 1906.

PARRY SOUND COPPER MINING CO., LTD. **ONTARIO.**

Office: 604 Germania Life Insurance Bldg., St. Paul, Minn. Mine office: Parry Sound, Muskoka district, Ont. Robert Forbes, agent. Lands, circa 14,000 acres, including the McGown and Wilcox mines, on the eastern shore of Georgian Bay. Ores are auriferous chalcopyrite and bornite. Has a 10-stamp mill. Idle.

PAR VALUE CONSOLIDATED GOLD & COPPER CO. **COLORADO.**

Attempted, 1905, apparently to avoid payment of debts, to secure a new bond and lease, through sundry directors. Latter kept the bond and company apparently is hopelessly insolvent—hoist by its own petard.

PAR VALUE GOLD MINING CO. **COLORADO.**

Succeeded, 1900, by Par Value Consolidated Gold & Copper Co.

GEWERKSCHAFT PASCHA. **GERMANY.**

Office: Düsseldorf, Rheinprovinz, Germany, Paul Müller, president. Has ores of iron, copper, zinc and lead, employing circa 25 men, at last accounts.

PASS CITY COPPER CO. **MEXICO.**

Office: care of H. E. Runkle, El Paso, Texas. Lands, sundry claims, in the Sierra de Las Arradas, district of Bravos, Chihuahua, Mexico, developed by two shafts, one tunnel and an open-cut, with a total of about 350′ of openings, showing stringers of oxide and carbonate copper ores, in limestone.

PATHFINDER CONSOLIDATED MINES, LTD. **BRITISH COLUMBIA.**

Mine office: Grand Forks, Yale district, B. C. Ores carry gold, silver and copper. Has steam power. Presumably idle.

PAUDORNE COPPER MINING CO. **VIRGINIA.**

Company refused to accept a letter addressed to Houston, Virginia. Organized December, 1902, under laws of South Dakota, to do a general mining business in Virginia. Seems suspiciously reticent.

PAVO RICO MINING CO. **MEXICO.**

Controlled by Atlas Exploration & Mining Co.

PAYMASTER COPPER MINING CO. **WYOMING.**

Letter returned unclaimed from former mine office, Encampment, Wyo.

PAYMASTER MINE. **ARIZONA.**

Owned by Grand Gulch Copper Mining Co.

PEACH BOTTOM COPPER CO. **NORTH CAROLINA.**

Letter returned unclaimed from former mine office, Elk Creek, N. C.

PEACOCK COPPER CO. **CALIFORNIA.**

Dead. Described in Vols. IV and V.

PEAK COPPER CO. **MICHIGAN.**

Former secretary of company claims corporation never was organized.

PEAK MINE. **AUSTRALIA.**

Mine office: Peak Downs, Clermont, Central Queensland, Australia. Very rich ore was obtained, at the opening of the mine, and property paid £278,250 profits to shareholders, after trucking ore about 300 miles. An attempt to reopen the mine, circa 1898 was frustrated by a decline in copper

and the death of the manager. Property is freehold and exempt from labor conditions. Mr. W. Lees, of Brisbane, states that a considerable tonnage of ore is in sight, and that the property is worthy of investigation.

PEARL COPPER MINING CO. **COLORADO.**

Letters returned unclaimed from former mine office, Pearl, Colo.

PEARL COPPER MINING & SMELTING CO. **COLORADO.**

Office: care of P. B. Coolidge, manager, Lander Wyo. Mine office: Pearl, Larimer Co., Colo. W. L. Culbertson, president; R. E. Coburn, secretary; T. J. Riley, superintendent. Lands include the Copper King and Swede groups, opened by a 400′ shaft, showing considerable ore of excellent average grade, values being in copper, gold and silver. Has steam power. Is under lease, expiring 1906, to Western Mining & Smelting Co.

PEARL & LILLIE MINES. **COLORADO.**

Mine office: Newett, Chaffee Co., Colo. F. H. Denman, superintendent, at last accounts.

PEARL SMELTING CO. **COLORADO.**

Works office: Pearl, Larimer Co., Colo. Is controlled by the National Mining & Milling Company. Plant is a small smelter, partly completed, at last accounts, planned eventually to include a 36x66′ power-house with a 175-h. p. steam plant, 20x24′ smithy, 21x50′ office, ore-bins, a 54x62′ main furnace building, of steel, having a 175-ton blast-furnace, with two 80-h. p. boilers, a 150-h. p. engine and a No. 7 Connersville blower. Company seems to have met with unexplainable delays in putting its smelter in blast, and works are not regarded as a serious attempt as a reduction plant.

PECOS COPPER CO. **NEW MEXICO.**

Office: 581 Arcade, Cleveland, Ohio. Mine office: Cowles, San Miguel Co., N. M. Employs 40 men. Alfred H. Cowles, president; I. C. Clifford, vice-president; Frederick H. Swan, secretary and treasurer. Organized 1904, under laws of Michigan, with capitalization $50,000, shares $25 par, as a development company, and plans reorganization, with greatly increased capitalization, after opening of mines to a size warranting such action.

Lands, 15 claims, of which 7 are held under option, also miscellaneous lands, giving total holdings of 1,200 acres, in the Hamilton district, circa 12 miles over the mountains from Santa Fé, near the Pecos river. Lands are well timbered, and a considerable water power is available from the river. Country rocks are granite, slate and quartzite, with underlying strata of lower Carboniferous age, cut through by the valley of the Pecos river. Property shows sundry contact veins, having a ferruginous quartzite on the south, with granite and slate to the north, of which 2 veins, under development, show a mineralized zone ranging up to 225′ in width, with ore bodies of 12′ to 80′ width, carrying massive chalcopyrite and massive sphalerite, former giving average assays of 3.5% copper, 3.75 oz. silver and $1.60 gold per ton. Development is by the Katydid shaft of 60′ and the Evangeline shaft of 310′, with 450′ of tunnels and about one-half mile of workings in all. An 18″ vein of coal has been opened by 470′ of tunnels. Property

was opened 1882, and closed shortly thereafter, owing to the zinc ores near surface proving unworkable. Recent developments show a 44′ vein of sphalerite, carrying 1% to 5% copper, and $1 to $5 gold and silver values per ton. The zinc ores will require special treatment, but the copper ores, being rich in sulphur and iron, are well suited to pyritic smelting.

Equipment includes a 165-h. p. steam plant, with 2 hoists, good for 600′ each, and a 3-drill Rand air-compressor. The mine has several buildings and is 17 miles from the Santa Fé railway. Company seems managed conservatively, and property gives promise of making, with adequate development, a large low-grade copper mine.

PEERLESS GOLD & COPPER MINING CO.

Office: 153 La Salle St., Chicago, Ills.

PEERLESS MINING & MILLING CO. **COLORADO.**

Office and mine: Salida, Chaffee Co., Colo. Lands, 6 claims, on Cyclone Mountain, 16 miles west of Salida, opened by an 800′ crosscut tunnel, showing ores carrying values in lead, copper, gold and silver, lead predominating. Presumably idle.

PEHOVAZ HERMANOS y CA. **PERÚ.**

Mine office: Uliachiu, Cerro de Pasco, Junin, Perú. Firm operates a mine that is a small producer of silver and copper.

PELLON COPPER KING MINES. **ARIZONA.**

Lands, sundry claims, in vicinity of Tucson, Pima county, Arizona.

PEÑA COPPER MINES, LTD. **SPAIN.**

Offices: 3, Laurence Pountney Hill, Cannon St., London, E. C., Eng. Mine office: Nerva, Huelva, Spain. Carl Heinrich von Siemens, chairman; Nicol Brown, deputy chairman; preceding officers, Carl Chrambach, Chas. Laudour, Baron C. H. Von Merck, A. Straube and Arthur Spitzer, directors; T. Stevenson, Dick, secretary; T. D. Lawther, general mine manager; Wm. Neil, auditor; Budd, Johnson & Jecks, solicitors; London & Westminster Bank, bankers. Organized Sept. 19, 1900, with capitalization increased January, 1905, to £600,000, shares £1 par; issued, £514,600. Debentures, £200,000 authorized, at 5%; £81,000 outstanding, bonded indebtedness having been reduced from £193,800 debentures issued. For fiscal year 1905, net profits were £17,293, from which a 4% dividend was paid. Lands, 183 hectareas, 2 miles northeast of the Rio Tinto, being the Peña del Hierro group of 17 old mines, taken over from the Sociedad Peninsular de Brussels. Extraction is mainly from open pits, and large quantities of overburden are removed, the amount of stripping done in 1905 having been 195,430 cubic metres. Eventually the capping will be removed entirely, and the mine worked open-cast, down to the ninth level. Present extraction is mainly opencast, though some underground mining is done. Reserves are estimated at upwards of 2,000,000 long tons.

Ores produced are divided into cupreous pyrites, iron pyrites and washed sulphur ore, latter being ores previously leached for copper, and sold later for sulphur contents. The mining plant is modern and complete, including hoists, crushing plant, shops and dwellings. The leaching plant has settling

tanks, boilers, pumps, etc. A 2½-mile private railway, equipped with one locomotive and 14 cars, connects the mines and works with the nearest railway. The cupriferous iron pyrites of the Sierra Morena lend themselves with special aptitude to copper extraction, by a combination of natural weathering and artificial leaching, and this process, in use by the Peña, gives cheap costs, but entails long waits and tremendous investments before profits are returned, an average of 8 to 10 years being required to extract all copper values, which means that the operators must put more in than is taken out, for this length of time. For 1902 the actual production of refined copper was only 624 long tons, although the ores placed in process of extraction were estimated to carry 2,700 long tons, and in 1905, the discrepancy, though not so marked, was very great, about one-third of the copper mined being put on the market. Production, 1905, was cement copper carrying 1,724,800 lbs. fine copper and circa 110,000 long tons of pyrites, sold for sulphur contents. At the close of 1905 the quantity of ore in the tereros, or leach-heaps, was 480,803 long tons. Eventually the annual discrepancy between ore production and copper production will be overcome, and the profits will be correspondingly great. The property is of great value, and has an excellent management.

SOCIEDAD ANONIMA MINERA DE PEÑAFLOR. **SPAIN.**

Office: Bilbao, Vizcaya, Spain. Mine office: Peñaflor, Sevilla, Spain. Don Luis de Salazar, president; Don P. Alzaga, manager; Don Angel Iznarde y Alzate, superintendent. Organized Jan. 1, 1901, under laws of Spain, with capitalization 4,500,000 pesetas. Property includes the Concepción, Descuido and Segunda Preciosa mines, which were unwatered by an electric pumping plant, and were preparing for production upon a considerable scale, at last accounts.

PEND D'OREILLE GOLD & COPPER MINING CO. **WASHINGTON.**

Mine office: Davenport, Lincoln Co., Wash. Presumably idle.

PENINSULA MINING & SMELTING CO. **MEXICO.**

Lost property, circa 1904. Fully described in Volume V.

SOCIEDAD PENINSULAR DE BRUSSELS. **SPAIN.**

Wound up, 1900, and mines sold to Peña Copper Mines, Ltd.

PENN CHEMICAL WORKS. **CALIFORNIA.**

Office and mine: Campo Seco, Calaveras Co., Cal. Employs 175 men. J. K. Harmon, president and general manager; Albert C. Harmon, secretary, treasurer and superintendent; A. L. Willie, assistant superintendent; John Cocking, mine foreman; Frank Baird, smelter superintendent. Organized 1880, under laws of California.

Lands, 4 claims, area 80 acres, patented, also a 20-acre smelter-site, 640 acres of timber lands and 450 acres miscellaneous lands, giving total landed holdings of 1,190 acres, in the Campo Seco district. Property includes the Campo Seco, Hecla, and Satellite mines, which were considerable producers, circa 1860-1870. Mines were developed by 5 tunnels and 2 shafts, latter of 500′ and 700′, cutting a 30′ ore body, at depth of 400′. Ore is slightly argentiferous and auriferous chalcopyrite, associated with sphaler-

ite and iron pyrites, with gangue ranging from talcose schist, through clay, to quartz.

Equipment includes steam plants of 150 h. p. at the mine, and 400 h. p. at the smelter. Shafts have 44-h. p. and 100-h. p. hoists, good for depths of 1,000′ and 2,000′, with a 14-drill Ingersoll-Sergeant air-compressor. Buildings include a 25x30′ machine-shop, 16x24′ carpenter shop and 12 miscellaneous structures.

The smelter, ¼ mile from the mine, receives ore by tram, and is equipped with a 100-ton blast-furnace and 50-ton reverberatory furnace, turning out matte, brought to 60% copper tenor in three heats, shipped to the American Metal Co., Ltd., New York, for refining. Management is said to plan installation of 8 roasters. Property is served by the Southern Pacific railway, 6 miles distant, and a branch may be built from Bruson to Campo Seco. Fuel is petroleum for power purposes, and coke for smelting. A little copper cement is produced by leaching the old waste-burrows. Management is considered good, and property promising.

PENN MINING CO. **CALIFORNIA.**

Title changed to Penn Chemical Works.

PENN MINE. **MICHIGAN.**

Mine held by Lake Copper Co. Fully described in Volume II.

WILLIAM PENN MINING CO. **WYOMING.**

Office: Lewisburg, Pa. Mine office: Encampment, Carbon Co., Wyo. J. E. Hedding, president; J. W. Van Valzale, secretary and treasurer; S. E. Phelps, manager. Organized, 1903, under laws of Wyoming, with capitalization $1,000,000, shares $1 par; Lands, 3 claims, area 60 acres, in the Upper Platte district, showing a 4′ vein carrying carbonate ores and chalcopyrite, opened by a 75′ shaft. Idle.

PENNSYLVANIA AND CANANEA COPPER CO. **MEXICO.**

Offices: 52 Broadway, New York, and 522 Bradbury Building, Los Angeles, Cal. Mine office: Baca Bldg., La Cananea, Sonora, Mexico. Robert Mitchell, president and general manager; Henry J. Stevens, vice-president; E. B. Crary, treasurer; Geo. A. Fitch, secretary; T. H. Collins, superintendent. Organized under laws of Arizona, with capitalization $5,000,000, shares $10 par; issued, $2,500,000. Lands, 587 pertenencias, including the Collins group, of 305 pertenencias, Arizpe group, of 40 pertenencias, Homestake group, of 60 pertenencias, Last Chance group, of 32 pertenencias, and Gladys group, of 150 pertenencias, latter adjoining the Massey mine of the Greene Consolidated. Has secured considerable development and company plans production by shipping ore to the works of the Naco Smelting & Refining Co., when built.

PENNSYLVANIA CENTRAL GOLD MINING CO. **COLORADO.**

Mine office: Russel Gulch, Gilpin Co., Colo. J. J. Riley, superintendent, at last accounts. Property is the Delaware Chief mine, carrying ores of gold, silver and copper. Has steam power.

PENNSYLVANIA COPPER CO. **NEW MEXICO.**

Office: Lyndhurst Blk., Shamokin, Pa. Letter returned unclaimed

from former mine office, San Pedro, Santa Fe Co., N. M. Thos. A. Lister, Albuquerque, N. M., president and general manager; M. F. Nagle, secretary and treasurer. Lands, 9 claims, area, 180 acres, in Bernalillo county, New Mexico. Has 8 fissure veins, of which one is developed by a 230′ shaft, ore from which has given smelter returns of 21% coppper and 13 oz. silver per ton. Presumably idle.

PENNSYLVANIA COPPER MINING CO. **PENNSYLVANIA**

Office: 1208 Arch St., Philadelphia, Pa. Mine office: Pottstown, Montgomery Co., Pa. Franklin D. Hoffman, president; Edwin J. Quigley, vice-president; Paul Morris, secretary and treasurer. Organized December, 1902, under laws of Delaware, with capitalization $200,000, shares $1 par. Lands 176 acres, 2 miles from Pottstown, slightly developed by a shallow shaft with a few short drifts, showing ores assaying 5% to 10% copper. Installed a 50-ton water-jacket blast furnace, in 1904. Not favorably regarded, and presumably idle.

PENNSYLVANIA MINE. **WASHINGTON.**

Letter returned unclaimed from former mine office, Egypt, Wash.

PENNSYLVANIA MINING CO. **NEW MEXICO.**

Office: Franklin, Pa. Mine office: Los Cerillos, Santa Fe Co., N. M. Wm. A. Brown, superintendent. Ores carry gold, silver, copper and lead. Has gasoline power. Presumably idle.

PENN-WYOMING COPPER CO. **WYOMING.**

(Revised August, 1907, for fourth edition, Vol. VI.)

Office: 731 Monadnock Bldg., Chicago, Ills. Branch offices: 1308-74 Broadway, New York, N. Y., and 14 Great Winchester St., London E. C., Eng. Mine office: Rudefeha, Carbon Co., Wyo. Works office: Encampment, Carbon Co., Wyo. E. M. Cobb, president; Frank Burke Draper, first vice-president; Earle A. Norton, secretary and general manager; preceding officers constitute the executive board; J. E. Haskell, second vice-president; preceding officers; J. R. Leonard, Fredk. Davidson, D. H. Lambertson and J. Q. Riddle, directors; L. M. Fishback, treasurer; Geo. H. Hand, general superintendent.

Organized September 13, 1904, under laws of Wyoming, with capitalization $10,000,000, shares $1 par; issued, circa $9,000,000. Succeeded North American Copper Co., organized 1902, under laws of New Jersey, with capitalization $20,000,000, shares $100 par. Paid dividends at rate of 6% yearly for

two years until March, 1907, when dividend rate was increased to 8 %, but dividend of July, 1907, was canceled, on account of burning of the smelter. Amount of dividends paid to July 1st., 1907, was $531,250 on outstanding share capital of $5,500,000. Considerable of the company's stock is held in London. Direct titles to different properties of company are held through the Haggarty Copper Mining Co., Battle Lake Tunnel Site Mining Co., Encampment Smelting Co., Encampment Tramway Co., Encampment Pipe Line Ditch Co., Encampment Water Works Co., Encampment Land & Town Lot Co., Carbondale Coal Co., Emerson Electric Light Co., North American Mercantile Co. and Saratoga & Encampment Railway Co. These properties are owned outright, except founders shares, with exception of $138,600 stock of the total issue $2,500,000 stock of the Battle Lake Tunnel Site Mining Co. Latter named company had outstanding on June 15, 1907, bonds aggregating $13,400.

Lands, including holdings of the Battle Lake Tunnel Site Mining Co., aggregate 1,373 acres, property including 773 acres of patented mineral lands, 80 acres of coal lands, a 24-acre millsite, limestone quarry, 320 acres of timber lands and the entire townsites, less lots sold, of Encampment, Rudefeha and Rambler.

The Ferris-Haggarty mine, discovered 1898, shows an outcrop of decomposed spongy limonite with carbonate copper stains, under which is a fissured zone of about 20′ average width, having a mica-schist hanging-wall and slightly stratified footwall, with a strike of northwest and southeast and dip of 50° to the southwest, with a diorite dike on the hanging wall and a quartzite footwall. At a depth of about 40′ the ore is massive bornite, carrying 30 % to 45 % copper and $2 to $9 gold and silver per ton. This rich zone has been partially worked out, the granite being replaced by disseminated chalcopyrite in the lower levels, estimated to give an average of 10 % copper, 1.75 oz. silver and $6 gold per ton, but yielding, in actual production, about half to three-fourths of these values, on account of mixed charges including the old mine dump averaging about 4 % copper. Work during summer of 1907 has shown a new ore body of much promise, opened by crosscuts from the 140′ level, the ore being very rich, and in considerable quantity. This new ore body is estimated at 10′ width, 75′ depth and 350′ length, and is estimated by superintendent Hand as averaging better than 20% copper. The Ferris-Haggarty, opened by a 1490′ main working tunnel intercepting the contact vein, connects with a 540′ shaft, and a 180′ winze has been sunk below the

tunnel level. The mine has 1¼ miles of underground workings. All ore is milled down to the tunnel level through chutes, and hauled to ore-bins at the portal by a compressed air locomotive. The plant at the mouth of the tunnel includes three 180 h. p. boilers, a three-stage air-compressor, furnishing air at 1250 pounds pressure per square inch to the locomotive, and a 26-drill air-compressor for rock drills. There also are carpenter and machine shops, timber framing shop, smithy, engine and boiler houses, warehouse and ore-bins. The Osceola mine, adjoining the Ferris-Haggarty, is but slightly developed.

The Doane-Rambler mine, 30 claims, area 600 acres, also 80 acres of miscellaneous lands, shows country rocks of granite, diorite and quartzite carrying numerous veins, of which five, under development, average about 4′ width, showing oxide ores above and sulphides below, latter mainly chalcopyrite, but with considerable calcocite, covellete and bornite, which have shown an average assay of 40.7% copper from 16 carload shipments. The mine is opened by a 500′ working shaft and three long tunnels, longest 900′ and 1600′, with upwards of one mile of underground workings, and is considered a promising property. Plant includes three boilers, air-compressor and a 70h. p. hoist. The Doane-Rambler has about 12,000 tons of 10% ore on the dumps ready for smelting.

The smelter, at Encampment, is 16 miles from the mine, and connected therewith by a Leschen aerial tramway, which is the longest installation of the sort ever made. The tram was built in 4 sections, of 4 miles each, but is now operated in two 8-mile sections, and by steam power, generated at 2 stations 8 miles apart, each station having storage-bins. The length of cables is 293,275′; weight of cables, 439,669 lbs.; number of tension stations, 16, four being double; greatest elevation above sea level, 10,690′, on Bridger Peak; highest tower, 69′; number of towers, 170; highest span, 250′ above surface, at Heaning's Gulch; longest span, 2,200′, across Cow Creek cañon; general rise, 900′; number of buckets, 972, in service; capacity 700 lbs. each; speed, 5½ miles per hour; maximum daily capacity, upwards of 1,000 tons. Plant has automatic filling and discharging devices and was built so that its capacity can be doubled, if desired. A two-mile branch tramway from the main line to the Doane-Rambler, now under construction, is to be completed in 1907.

Improvements at the works, located on the banks of the river, at En-

campment, include concentrator, smelter, power plant, machine shop, pattern shop, boiler shop, foundry, sawmill, smithy, office and laboratory. Heretofore water power has been depended upon, but this has proven somewhat uncertain, varying from 600 to 1200 h. p., hence has been supplemented by a steam plant with three 200-h. p. Babcock & Wilcox boilers and a 500-kw. Westinghouse-Parsons steam turbine, capable of developing an overload of 1200 h. p. The water-power plant brings water through a 48″ wooden pipe, for 4 miles, from a 23′ dam on the south fork of the Grand Encampment river. The water drives 6 DeRemer impact wheels, direct-connected with generators furnishing current for a common system. The Encampment Water Works Co. has a franchise for supplying water to the town of Encampment, and the Emerson Electric Light Co. has the lighting franchise of the town.

The old concentrator, 250x350′ in size, was burned in March, 1906, and has been replaced with a larger and better designed and equipped plant. The new mill, of 800 tons daily capacity, was completed July, 1907, and is in two parts, terraced throughout, with a drop of about 60′, which permits handling of material mainly by gravity. The milling plant includes storage bins, picking tables, a 700-tonBlake crusher, 4 roughing and finishing rolls, automatic sampler, revolving trommels, hydraulic classifiers, two 700-ton Hancock jigs, two pairs of grinding rolls, two 6′ Calumet regrinding mills, 12 Wilfley tables, 8 Frue vanners and a V-shaped slime tank 12′ deep, 28′ wide and 70′ long. The new mill is well designed and equipped, and is planned to make concentrates of 25% to 30% copper tenor. Tailings from the new mill are said to assay under one per cent. of original metallic values—a marvelous accomplishment.

The old smelter was burned May 10, 1907, this being the second bad fire in three years. A new smelter, of steel frame on concrete foundations, was completed August 16, 1907. Equipment includes a 100-ton Davies straight-line roaster, 40-ton mechanical straight-line roaster, and two water-jacket blast-furnaces, rated at 200 and 300 tons respectively. The converter department has a 25-ton electric overhead traveling crane, 3 converter stands with electric power and 6 shells of the Copper Queen type, and a 7′ silica mill with pneumatic rammers, linings being made of a mixture of ground quartz and clay, and replaced every third charge. There also is a White mineral press for briquetting fines and flue-dust. Slag is granulated by a jet of water and washed through launders to the dump. The black copper produced by

the old smelter averaged 99.3% fine. Blast for the furnaces is furnished by No. 6 Connersville and No. 7 Greene blowers, and blast for the converters is supplied by a Riedler air-compressor with capacity of 6,000 cubic feet of free air per minute compressed to about 15 lbs. per square inch, electrically driven.

Fuel for power purposes is wood, costing $3.50 per cord, and the company has mines of lignite at Carbondale, 12 miles from Encampment, on the line of the aerial tram. Coke for smelting has cost $12 per ton, owing to high transportation charges, caused by lack of rail connection, but will be considerably reduced on completion of the railway to Encampment.

The property has been handicapped from the start by inadequate transportation facilities, as the smelter was 45 miles from Walcott, the nearest railway station. The Saratoga & Encampment railway, building August, 1907, runs from Walcott, via Saratoga, to Encampment. The line is of standard gauge, and was giving regular train service between Walcott and Saratoga in July, 1907. Capitalization of the Encampment & Saratoga Railway Co. is $1,000,000, stock being owned outright by the Penn-Wyoming, and an issue of $750,000 bonds remains unused in the Penn-Wyoming treasury. Company stated, July, 1907, that $600,000 cash for the completion of the line was in the Penn-Wyoming treasury.

The mine secured more or less production in 1902 and 1903, and the smelter was blown in again June 28, 1905, running continuously until October 20, 1905, and making in that campaign 2,385,629 lbs. fine copper, 3.549 oz. fine silver and 226 oz. fine gold, from 28,039 short tons of ore smelted, from which figures it is evident that the average quantity of ore smelted daily was slightly under 300 tons, and that the net returns were 4.25% copper per ton of ore smelted, made at a cost of slightly less than 9 cents per pound. Net receipts of 1905 production are given as $349,555.47, an average of 14.65 cents per pound. For 1906 production was 2,402,985 lbs. copper, secured at a gross cost for mining, smelting and hauling to railroad of $203,000.57, giving average costs of 8.45 cents per ton, showing a marked gain over the preceding year, gross receipts being $378,786.88, leaving a profit of $175,786.31. In 1906 smelter costs were $64,213.24, or $2.46 per ton on 26,145 tons of ore smelted, or 2.67 cents per pound on finished product, with an average return of 5.36% copper per ton of ore smelted, showing an increase in average percentage of ore and a decrease in costs.

The smelter was blown in again on March 15th, 1907, and ran until burned

May 10, 1907, producing 1, 580,000 lbs. copper from 11,000 tons of ore, a return of 7.2% metal, showing a further considerable gain in average grade of ore treated, production being at the rate of nearly 9,000,000 lbs. yearly for the 55 days in which the smelter was in commission. Costs have not been secured, but should have been no higher than in 1906.

Assets of the old North American Copper Co. were bought at public sale by the present company. A suit against the Penn-Wyoming by shareholders of the North American has been decided against the plaintiffs, who apparently have grounds for suit against the old management of the North American company, but lack grounds for complaint against the Penn-Wyoming Copper Co. The assertion made in the first edition of Vol. VI. of the Copper Handbook that Mr. E. M. Cobb, president of the Penn-Wyoming, formerly was connected with Mr. John S. Carey in the management of the North American was a misstatement, founded upon misapprehension, by which an injustice, unintentional, but none the less real, was done Mr. Cobb, and for which a voluntary apology is tendered herewith. Mr. Cobb's only connection with Mr. Carey or with the old North American company was that of an unfortunate investor.

In past editions of the Copper Handbook the Penn-Wyoming Copper Co. has been criticised for two shortcomings and one misfortune. The misfortune was the lack of a railroad, and it was pointed out several years ago that it was idle to hope for permanent success, steady operation and large production without railroad connection. The truth of this has been seen and admitted by the company, which, in August, 1907, is completing a railroad to connect with the outside world. The second criticism of the Copper Handbook was directed against the payment of dividends contemporaneously with the raising of additional capital by sale of stock. The same thing has been done by powerful and successful copper mines, but is a policy that is wrong, no matter by whom followed or endorsed. The suspension of dividends in July, 1907, was wise and proper. The third criticism was made because of the inability of the Copper Handbook to secure a full and satisfactory financial statement from the Penn-Wyoming Copper Co. The last criticism has been met by a balance sheet issued to all shareholders on Jan. 1, 1907. This balance sheet shows assets of $8,751,128.42, of which $8,567,915.42 is for investment account, being cost of shares of the various subsidary companies

Other asset items are $78,443.31 due from subsidiary companies; $17,936.05 operating and miscellaneous expenses; $76,481.01 accounts receivable, practically all due from subsidiary companies; $3,657.50 bills receivable of the Battle Lake Tunnel Site Mining Co., and $6,695.13 cash on hand. Estimates of real value of the holdings of the various subsidiary companies would vary according to the personal opinions of those making such estimates, but the figures of the company show the investments according to the books. Liabilities were, capital stock issued, $7,983,534, which amount is, in August 1907, nearly $9,000,000; notes payable, $370,086.76 due on the Ferris-Haggarty mine, and $318,959.62, trustee notes running to A. F. Richardson. These notes are secured to the trustee by the underlying notes of various subsidiary corporations, aggregating $1,390,798.62, but the trustee has agreed to cancel all notes of the various subsidiary companies upon payment of the Penn-Wyoming notes for $318,959.62, this amount being the balance due on the underlying notes, on which $1,072,839 already has been paid. Other liabilities are $104.73 and reserve fund, $78,443.31.

The anomalous arrangement by which stock of the Penn-Wyoming, while all nominally common stock, and on a parity, was, for all practical purposes, divided into three classes, has been terminated, there being now only common stock, with every shareholder on the same basis.

The Penn-Wyoming has suffered in the past from a variety of ills, but substantial progress has been made toward the alleviation or elimination of its various troubles, during the past eighteen months. The railway so badly needed will be running within a few weeks. Underground openings have been extended, the destructive fires of the past will be guarded against in the future by steel buildings; litigation over titles has been decided in the company's favor; payment of dividends while selling stock has ceased, and a full balance sheet has been furnished shareholders. The cost-sheets of the 1906 and 1907 smelting campaigns show that copper in considerable quantities can be produced at reasonable prices, and the ultimate success of the mine seems dependent solely upon its ability to furnish large tonnages for steady smelting operations. The management is energetic, and, while laboring in the past under many difficulties, and having done things that have been criticised by the Copper Handbook, has made progress in the right direction, and seems worthy of the confidence of the shareholders.

PHILIPS RIVER GOLD & COPPER CO., LTD. **AUSTRALIA.**

Office: Salisbury House, London Wall, London, E. C., Eng. Chas. Kaufman, chairman; E. Protheroe Jones, secretary; Fred Morgan, mine manager. Organized January, 1906, with capitalization £100,000, shares £1 par. Lands, 247 acres, held under lease and option, in Western Australia. Property includes the Mount Benson mine, having a 200′ shaft, the Mount Desmond mine, in a prospecting-stage, which is to have a steam hoist, and the Mount Cattlin mine, also a prospect. Equipment includes Babcock-Wilcox boilers, a 1,000′ hoist and a 5-drill air-compressor.

PHOENIX CONSOLIDATED COPPER CO. **MICHIGAN.**

Office: 15 William St., New York. Mine office: Phœnix, Keweenaw Co., Mich. John R. Stanton, president; Wm. C. Stuart, vice-president; J. Wheeler Hardley, secretary and treasurer; Frank McM. Stanton, agent; preceding officers and J. Oppenheim, directors. Organized April, 1899, under laws of Michigan, with capitalization $2,500,000, shares $25 par; paid in, $12.

Official returns to the state of Michigan, as of date Jan. 1, 1905, disclose the following figures:

Amount of cash paid in on capital stock	$1,200,000.00
Amount paid in by conveyance of property	500,000.00
Entire amount invested in real estate	505,000.00
Amount of personal estate	87,307.44
Amount of floating debt	159,816.97

Considerable equipment has been sold, since June, 1905, but a considerable indebtedness must remain unliquidated.

Lands, 2,505 acres, in Keweenaw county, Michigan. Five different fissure veins have been opened, and more or less mining done thereon, at various times. The old Phœnix mine, included in the present consolidation, is famous for having produced the largest mass of native copper ever found, this weighing upwards of 500 short tons. The property also carries the Ashbed lode, which has been slightly developed by an exploratory tunnel.

The mine has extensive openings, and a modern equipment. The property was worked for 6 years, without success, and was closed down June 15, 1905. Production, 1905, was only 273,219 lbs. fine copper. The Phœnix Consolidated was described very fully in Vol V, and the various old properties entering into the consolidation are very fully described in Vol. II.

PHOENIX GOLD & COPPER MINING CO.

Office: 218 La Salle St., Chicago, Ills.

PHOENIX GOLD MINING CO. **CALIFORNIA.**

A reorganization, under a new name, of the Mt. Shasta Gold Mines Corporation. Property is an alleged gold mine, etc. Management and methods thoroughly rotten.

PHOENIX MINE. **AUSTRALIA.**

Mine office: Cobar, Robinson Co., N. S. W., Australia. Property is but slightly developed, and presumably is idle.

PHOENIX MINING CO. **UTAH.**

Mine office: Bingham Canyon, Salt Lake Co., Utah. Employs 50 men. Equipment includes an electric air-compressor. In July, 1905, was shipping circa 60 tons of milling ore daily, in addition to producing a little smelting ore.

PHOENIX MINING SYNDICATE. **WASHINGTON.**

Office: Seattle, Wash. Mine office: Berlin, King Co., Wash. Lands include the Mona group, on the east side of Miller river, 2½ miles from a railroad, showing a 60′ vein carrying a 20′ paystreak of chalcopyrite, mainly of concentrating grade, opened by a shaft of 50′ and by tunnels of 80′, 230′ and 700′.

PICACHO BLANCO MINING CO. **ARIZONA.**

Mine office: Morristown, Maricopa Co., Ariz. M. E. Waldstein, president; T. O. Otis, secretary and treasurer. Is a consolidation of the San Domingo Gold & Copper Co. and Exposition Mining Co. Capitalization $5,000,000, shares $1 par. Lands, 31 claims, in Yavapai and Maricopa counties, Arizona. Has a 400′ main shaft, with free-milling gold ores said to average $22 per ton. Has gasoline power, a 15-stamp mill and a 25-ton cyanide plant.

MINAS PICACHO y CAMPO RICO. **MEXIÇO.**

Mine office: Bavispe, Sonora, Mex. B. J. Hone, manager. Ores carry copper, gold, silver and lead. Has water power, arrastras and a small adobe smelter. Idle.

FELIX R. PICASSO. **PERÚ.**

Office and mine: Cabeza Negra, Ica, Perú.

PIC COPPER & GOLD MINING CO. OF LAKE SUPERIOR, LTD. **ONTARIO.**

Neither office nor lands of company can be located. Property was advertised as "directly north of the Calumet & Hecla," which was a very misleading statement, as lands, if any, must have been on the Canadian shore of Lake Superior. Presumably dead.

PIEDMONT COPPER MINING & SMELTING CO. **VIRGINIA.**

Office: 320 Broadway, New York. Letter returned unclaimed from former mine office, Elkton, Rockingham, Co., Va. Maurice D. Brown, president; Jas. G. Blauvelt, vice-president; E. Porter Emerson secretary and treasurer; S. D. Brown, general manager. Organized 1901, under laws of New Jersey, with capitalization $2,000,000, shares $100 par, $30 paid in. Property shows 3 fissure veins, carrying occasional native copper and sulphide ores, with estimated average values of 6% copper, 10 oz. silver and $15 gold per ton. Veins are said to be persistent and traceable for about a mile, with geological conditions much the same as at the High Top mine, adjoining. Idle for several years.

PIEDRA y CA. **CHILE.**

Office and mine: Caldera, Atacama, Chile. Own a mine having steam power, which employed circa 100 men, at last accounts.

COMPAÑIA MINERA PIEDRAS VERDES y ANEXAS. **MEXICO.**

Mine office: Alamos, Sonora, Mex. Angel Almado, president; Joaquin A. Mange, superintendent. Has a 350′ shaft and 375′ tunnel, with steam

power plant. Made several small shipments, 1902, of matte averaging 40% copper, 20% lead and 200 oz. silver per ton. Employed about 75 men, at last accounts, but presumably is idle, owing to the Yaqui Indian uprising.

PIEDRAS VERDES MINING CO. **MEXICO.**

Office: El Fuerte, Sinaloa, Mex. Has argentiferous copper ores, slightly developed by tunnel. Presumably idle.

PIERCE MINING CO. **COLORADO.**

Letter returned unclaimed from former mine office, Central City, Colo.

PIKE HILL MINES. **VERMONT.**

Office: 82 Beaver St., New York. Mine office: Corinth, Orange Co., Vt. Employs 50 men. N. M. Macdonald, president; H. H. Knox, vice-president; H. G. Hunter, secretary; John H. Allen, treasurer; E. L. Smith, superintendent; preceding officers and D. S. Conant, directors; Knox & Allen, engineers. Organized January 9, 1906, under laws of Vermont, with capitalization $200,000, shares $100 par Annual meeting, second Tuesday in January. Lands, 101 acres, freehold, in the Corinth district, showing country rock of mica-schist, carrying lenses of chalcopyrite of estimated average tenor of 3.5% copper. Has 2 donkey hoists, and a concentrator covering 6,600 square feet, equipped with 1 Blake crusher, 2 sets of rolls and 2 magnetic separators. Nearest railroad is the Boston & Maine, 14 miles distant. Production, 1905, was 131,911 lbs. fine copper.

NEGOCIACION MINERA PILARES DE TERAS. **MEXICO.**

Mine office: Pilares de Teras, Sonora, Mex. Alberto C. Garcia, superintendent. Is primarily a silver mine, carrying small values in copper, gold and lead, opened by a 1,400′ tunnel and 700′ main shaft. Has steam power and employed about 200 men, at last accounts.

PILOT KNOB COPPER MINING CO. **NEVADA.**

Letter returned unclaimed from former office, Eau Claire, Wis.

LES MINES DE CUIVRE PILOU, LTD. **NEW CALEDONIA.**

Entire stock issue held by Caledonia Copper Co., Ltd.

PINAL COPPER CO. **ARIZONA.**

Reorganized, 1905, as Arizona Banner Copper Co.

PINE HILL CONSOLIDATED MINING CO. **CALIFORNIA.**

Office: 1316-141 Broadway, New York. Mine office: Wolf, Nevada Co., Cal. J. Frank Mase, secretary and treasurer; Cerf Rosenthal, superintendent. Has a copper ledge, claimed to be 100′ wide, carrying malachite, azurite, bornite, chrysocolla and native copper, with a gold vein on the footwall and an auriferous gossan capping, opened by a two-compartment main shaft. Also has a gold mine.

PINKHAM MINE. **ARIZONA.**

Letter returned unclaimed from former mine office, Chloride, Arizona.

RODOLFO PINOCHET. **CHILE.**

Office and mine: Lo Espejo, Santiago de Chile. Operates the Vieja copper mine. Has steam power and employed about 150 men, at last accounts.

PINTO COPPER CO. **NEW MEXICO.**

Office: 9 Bartles Bldg., Iola, Kansas. Mine office: Santa Rita, Grant Co.,

N. M. Geo. A. Bowlus, president; F S. Bennett, secretary and general manager Samuel Allen, superintendent. Organized July, 1902, under laws of South Dakota, with capitalization $2,500,000, shares $1 par. Lands, 8 claims, area 121 acres, in the Central district, showing 4 veins, carrying carbonate and sulphide ores said to average 20′ width and to carry 2.5% to 12% copper, 3 oz. to 10 oz. silver and $2 to $400 gold per ton. Opened by shafts of 65′, 75′ and 140′. Presumably idle.

PINTO CREEK COPPER CO. **ARIZONA.**

Title changed, circa 1902, to Arizona & Hancock Mining Co.

PINTO CREEK MINING & SMELTING CO. **ARIZONA.**

Office: 501 German Bank Bldg., St. Joseph, Mo. Mine office: Globe, Gila Co., Ariz. Thos. G. Cockrill, president; Chas. Reiminschneider, vice-president; Grant S. Watkins, secretary; J. W. Castle, treasurer; preceding officers, H. E. Bragg, J. Berger and Geo. B. Bright, directors; G. P. Fuller, superintendent. Organized December 11, 1896, under laws of Arizona, and capitalization increased, 1906, to $1,250,000, shares $1 par.

Lands, 21 claims, area circa 430 acres, in the Globe district, showing country rocks of granite and schists, with 6 fissure veins in granite, these having average widths of 3′ to 6′, carrying sulphide ores giving assays of 4% to 12% copper, 5 oz. silver and $2 to $10 gold per ton. Development is by shafts of 40′, 70′ and 570′, and by 8 tunnels of 100′ and upwards, 2 longest being 900′ and 1,100′, mine having a total of about one mile of underground workings. Main development is on the Yo Tambien claim, where a 570′ shaft shows a promising body of sulphide ore. The lower tunnel, of 900′ length, is connected with the upper workings. The Manitou claim has a 70′ shaft and 3 tunnels of 1,500′ aggregate length. Equipment includes a gasoline hoist and a 6-drill Sullivan air-compressor.

The property has an old 10-stamp mill and a 30-ton concentrator, connected with the mine by an aerial tram. Milling and concentrating tests were made, December, 1905, under the advice of Dr. L. D. Ricketts and Mr. J. C. Erman, and, as a consequence, the mill is being enlarged and reconstructed, and is to have a new equipment, from the Allis-Chalmers Co. The mill should be completed in the fall of 1906, and will have an initial capacity of 100 tons, with room in the structure for a 250-ton plant.

The management of this company is honest and eternally persevering. Large sums have been expended on the property, and indications are that the courage and persistence of the officers and shareholders will be rewarded by the making of a good mine.

PITKARANTA KOPPARBRUK. **FINLAND.**

Mine office: Pitkaranta, Viborg, Finland. The property was in operation for many years, until circa 1903, and was a small but steady producer, making circa 750,000 lbs. fine copper yearly. Ore is carried in a bed of "skarn," which is a granular mixture of augite, garnet and other ferromagnesian silicates, impregnated between the grains with chalcopyrite, which also occurs in veinlets. Ore body is of about 15′ width, and is low in grade, and the mine has been opened, more or less extensively, for about 1½ miles along the vein.

PIT RIVER GOLD, SILVER & COPPER MINING CO. **CALIFORNIA.**

Letter returned unclaimed from former mine office, Redding, Cal.

PITTSBURG & ARIZONA MINING CO. **ARIZONA.**

Mine office: Charleston, via Johnson, Cochise Co., Ariz. Lands, include the Manila mine, with a double compartment shaft, planned to be sunk 400′, showing a promising vein of high-grade ore. Has a steam plant, with hoist, air-compressor and pumps.

PITTSBURGH & BOSTON COPPER CO. **MICHIGAN.**

Wound up. Property, the Cliff mine, sold to Tamarack Mining Co.

PITTSBURG & CHIRICAHUA DEVELOPMENT CO. **ARIZONA.**

Mine office: Paradise, Cochise Co., Ariz. Lands, 16 claims, in the Chiricahua Mountains. Idle.

PITTSBURG CONSOLIDATED MINING CO. **UTAH.**

Office: care of J. E. Hill, Jr., secretary and treasurer, Salt Lake City, Utah. Mine office: Cottonwood, Salt Lake Co., Utah. S. M. Levy, president; J. H. Bigger, general manager; Dan'l Doyle, superintendent. Organized 1903, with capitalization $300,000, shares $1 par. Lands, 9 claims, in the Little Cottonwood district, showing a 20′ vein, between limestone and shale, carrying values of $35 to $40 per ton, with circa 1,500′ of workings.

PITTSBURG COPPER MINING & REDUCTION CO. **ARIZONA.**

Office: 300 Heist Bldg., Kansas City, Mo. Capitalization, $150,000,000. A swindle, promoted by Theodore Stegner, a notorious promoter of crooked mining schemes. Company held 40 acres of alleged copper mining ground in Box Canyon, on the Bill Williams Fork river, about 50 miles from Congress Junction, Arizona, and also claimed to own other lands, none of which can be located. Company's capitalization is preposterous, and the shares are absolutely worthless. Stegner, at last accounts, was peddling stock to widows, orphans and financially foolish male adults. Stegner has done time before, and should be locked up permanently.

PITTSBURG & DULUTH DEVELOPMENT CO. **ARIZONA.**

Succeeded, October, 1904, by Pittsburg & Duluth Mining Co.

PITTSBURG & DULUTH MINING CO. **ARIZONA.**

Office: Calumet, Mich. Mine office: Bisbee, Cochise Co., Ariz. Employs 80 men. Chas. Briggs, president; James Hoatson, vice-president; Thomas Hoatson, second vice-president; Louis W. Powell, third vice-president and general manager; Gordon R. Campbell, secretary; Peter Ruppe; treasurer; preceding officers, Thos. F. Cole, Geo. E. Tener, C. d'Autremont, Jr., and Chester A. Congdon, directors; Henry B. Paull, auditor; Frank Juleff, mine foreman; E. E. Whiteley, engineer. Organized October, 1904, under laws of Minnesota, with capitalization $3,000,000, shares $10 par; issued, $2,500,000. Annual meeting, second Monday in April. On December 31, 1905, had assets of $287,925.20 and liabilities of $16,957.53.

Lands, 17 claims, area 215 acres, patented. Property is surrounded by lands of the Copper Queen, Calumet & Arizona, Lake Superior & Pittsburg and Wolverine & Arizona. The mine is opened by the 1,267′ Congdon shaft, on the Black Bear claim, only 650′ from the Calumet & Arizona line, and by drift-

crosscuts on the 1,000′ and 1,100′ levels of No. 2 shaft of the Lake Superior & Pittsburg, and, owing to the very rugged topography of the company's lands, can produce to better advantage through the L. S. & P. shaft than through any shaft that can be sunk on its own lands. The collar of the shaft is 150′ above the collar of the Irish Mag shaft of the Calumet & Arizona, hence an allowance of 150′ must be made in correlating P. & D. levels connected with C. & A. openings. The shaft is connected with drifts on the 1,000′ and 1,100 levels of No. 2 shaft of the L. S. & P., and also with a drift-crosscut from the Irish Mag shaft of the C. & A.

Considerable ore has been developed at various points, especially on the 1,000′ and 1,100′ level drifts from the Lake Superior & Pittsburg, but the work done so far has been performed more with an idea to opening the mine than to showing big ore bodies. Several ore bodies, apparently merely apexes of large lenses lying lower, have been cut on the 1,000′ drift-crosscut, these ranging 5% to 12% in copper tenor, being mainly chalcopyrite, with considerable oxidized ore and native copper. In May, 1906, some good ore was cut in a drift on the Sunnyside claim. In addition to these lenses, diamond drill borings have cut several other ore bodies, apparently richer and larger. The ore now developed is of lower grade than the average of the district, though some very rich ore is shown on the 1,350′ level. The mine has a 1,000-gallon pump in a station on the 1,000′ level. Ore is raised through No. 2 shaft of the Lake Superior & Pittsburg.

Equipment includes a 300-h. p. steam plant, with a 12x36″ double-drum hoist, good for 1,400′, and a 5-drill straight-line air-compressor. The physical configuration of the property is such that production can be secured to much better advantage through Cole shaft of the Lake Superior & Pittsburg than through Congdon shaft of the Pittsburg & Duluth. The Superior & Pittsburg Mining Co. has consolidated the Pittsburg & Duluth with the Lake Superior & Pittsburg, Calumet & Pittsburg and Junction mines.

Production, 1905, was 390,179 lbs. fine copper, from 7,069 tons ore smelted, giving smelter returns of only 2.77% copper. The gold and silver product was $5,589.07, amounting to 79 cents per ton of ore smelted. The production of 1905 was gained in two and a half months smelting, the ores produced being used for fluxing the richer Lake Superior & Pittsburg ores. The P. & D. has richer ores, at greater depth, which will become available later.

PITTSBURG & HECLA DEVELOPMENT CO. **ARIZONA.**

Dead. Fully described in Vol. V.

PITTSBURG-IDAHO MINING CO. **IDAHO.**

Office: Kamiah, Idaho. Mine office: Greer, Nez Perce Co., Idaho. Employs 7 men. Jas. F. Bridwell, president; Daniel Laverty, vice-president and general manager; Hugh Laverty, secretary and treasurer; E. E. Krengel, engineer; preceding officers, Fred Worrell, Otto Gorke, Jas. Laverty, E. E. Krengel, William S. Pitman and Patrick Laverty, directors. Organized January, 1903, under laws of Idaho, with capitalization $1,000,000, shares $1 par; issued, $675,000. Annual meeting, last Saturday in January. Lands, 19 claims, area 380

acres, in the Lo Lo district, showing 6 contact veins between gneiss and quartz-porphyry, of which two, under development, range 50′ to 100′ in width, giving assays up to 12% copper, 14 oz. silver and $20 gold per ton, from cuprite, malachite, bornite and chalcopyrite. Has 20 pits and shafts, deepest 180′, and tunnels of 40′, 290′ and 600′, with a quarter mile of underground openings. Has gasoline power and 5 small mine buildings. Company plans installing a hydro-electric plant, utilizing power from the Clear Water river, adding a 12-drill air-compressor and continuing underground development.

PITTSBURG-JEROME COPPER CO. **ARIZONA.**

Office: 1219 Park Bldg., Pittsburg, Pa. Mine office: Jerome, Yavapai Co., Ariz. Employs 14 men. Thomas Houlette, president; Jos. Atkins, vice-president; C. S. Cochran, treasurer; T. D. McDonald, secretary; preceding officers, W. E. Crow, Robt. Stewart, A. C. Spindler and D. M. Clemson, directors; W. A. Edeburn, consulting engineer; D. S. Cochran, superintendent and engineer in charge. Organized 1904, under laws of Arizona, capitalization increased March 5, 1906, to $3,000,000, shares $1 par; issued, $1,482,699. On May 4, 1906, had cash assets of $37,707.28, without accrued liabilities. Annual meeting, first Monday in March. Is expending circa $2,500 monthly, on development.

Lands, 26 claims, area circa 520 acres, lying 2 miles south of Jerome, a short distance northwest of the Black Hills property and about midway between the United Verde and Equator mines. Development is by a shaft, sinking with three 8-hour shifts, 216′ deep in April, 1906, planned to be sunk to a depth of 1,000′. Equipment includes a 60-h. p. Fairbanks & Morse gasoline hoist, good for 1,800′, an Ingersoll-Rand 2-stage air-compressor, power drills and sinking pump. Development has been hampered by bad weather and a heavy inflow of extremely acid water. Management is good, and property is considered promising.

PITTSBURG-JEROME COPPER & GOLD MINING CO. **ARIZONA.**

Succeeded, circa 1904, by Pittsburg-Jerome Copper Co.

PITTSBURG MINE. **COLORADO.**

Mine office: Central City, Gilpin Co., Colo. Peter McFarland, superintendent, at last accounts. Ores carry gold, silver and copper.

PITTSBURG MINING & MILLING CO. **IDAHO.**

Letter returned unclaimed from former mine office, White Bird, Idaho.

PITTSBURG & MONTANA COPPER CO. **MONTANA.**

Office: 1124 Farmers' Bank Bldg., Pittsburg, Pa. Mine office: Butte, Silver Bow Co., Mont. Employs 325 men. J. H. Reed, president; Ralph L. Baggaley, vice-president; David E. Jackman, secretary and treasurer; Oscar Rohn, general superintendent. Organized July 9, 1902, under laws of West Virginia, with capitalization $30,000,000, shares, $100 par. Is said to plan a bond issue of $3,000,000, at 6%, to care for floating debt of company and provide additional working capital. Annual meeting, first Monday in August.

Lands, 46 claims, area 850 acres, also 634 acres miscellaneous lands, giving total holdings of 1,384 acres, in the Butte, Helena, Elk Horn and Greenhorn districts of Montana. The main tract, 260 acres, adjoining Anaconda Hill,

lying circa 2 miles east of the center of Butte, includes the McQueen placer and adjoining claims, formerly owned by Franklin Farrell. This tract is about 1¼ mile in length north and south, ¼ wide at its narrowest point, and about ¾ mile wide where adjoining the Silver Bow mine of the Butte & Boston. This property carries 4 veins of 2′ to 12′ average width, presumably continuations of the veins of the Butte & Boston. Owing to the great depth of overburden, the solid ledge was not reached until a depth of several hundred feet, and shaft sinking was difficult and costly, owing to the existence of considerable quicksand above the ledge. Development is by 2 shafts, known as Nos. 2 and 3, each of 1,240′ depth, with about 4 miles of underground workings. No. 2 shaft has 500-gallon electric pumps on the 700′ and 1,200′ levels, and the shafts are connected by a half-mile crosscut, on the 1,200′ level. Ore bodies are small, compared with the big veins to the eastward, but carry good silver values, ore ranging 3.5% to 12% copper and 8 oz. to 12 oz. silver per ton, with small gold values. In addition to the main property, in Butte, the company owns the Swissmont mines, near Elkhorn, Jefferson county, and the Chamounix mine, near Austin, Lewis & Clark county, Montana. The Elkhorn property, bought for $60,000, shows a large body of low grade ore, carrying 1.5% to 3% copper, of a character especially adapted to pyritic smelting. The Chamounix property includes the Christina group, of 6 claims, and the Fannie Parnall group of 33 claims. The Christina group has considerable development, and has shipped more or less argentiferous copper ore. The company also owns sundry mining claims at Pittsburg, 4 miles from Helena, Lewis & Clark county, Montana.

Equipment includes a 2,000-h. p. steam power plant and a 600-h. p. electric plant, of which 1,900 h. p. is used at the mine, and 700 h. p. at the smelter. The mine has a 500 h. p. hoist, good for 1,600′, and a 600 h. p. hoist, good for 1,300′, also a 40-drill Rand air-compressor and 20 power drills. Buildings include a 38x70′ brick carpenter shop, frame smithy, 2 engine-houses, 2 boiler-houses, a changing house, office building, laboratory, transmitter station and miscellaneous buildings, with a total of about 16 structures. The office building is equipped with a library, reception room, billiard room and café.

The reduction plant, known as the Pittsmont smelter, is connected by track with the north shaft and has a 200-ton blast-furnace, with room for 4 additional furnaces. The furnace is a remodeled Garretson pyritic smelter, with sundry changes made by Mr. Baggaley, and has given considerable trouble in operation. The Baggaley process of pyritic smelting calls for treating ore without water concentration, heap-roasting or carboniferous fuel. The process is said, by the management, to have been successful, but the supply of ore was inadequate to give the best returns. The smelter has one converter stand with 8x13′ shells, and 2 experimental Baggaley converters of smaller size. Product is blister copper, carrying 99% copper, 200 oz. silver and 3.5 oz. gold per ton, sent, for electrolytic refining, to the Nichols Chemical Co., New York.

The property has about 3 miles of railroad track, connecting the various parts of its mine and smelter. Production, 1905, was 790,600 lbs. fine copper, 81,911 oz. silver and 1,422 oz. gold, secured from 11,000 tons of ore smelted, giving average returns of 3.6% copper. The smelter was closed down April 14,

1906. Company plans adding a new hoist and increasing the size of the smelter. Property is considered valuable, though scarcely up to the average of the Butte camp in quantity or quality of ore, but it is evident, from the results secured, that pyritic smelting has not yet been made an entire success.

PITTSBURG & MOUNT SHASTA GOLD MINING & MILLING CO. **CALIFORNIA.**

Letter returned unclaimed from former mine office, Redding, Shasta Co., Cal. B. N. Scott, president; John Parish, secretary. Lands are the Bennington group, adjoining the Mountain Copper Co., showing ores assaying from $4 to $300 per ton in gold, silver and copper. Property idle for several years, but considered promising.

PITTSBURG & UTAH GOLD, SILVER, COPPER & LEAD MINING CO. **UTAH.**

Lands are supposed to be in the Ophir district, Tooele county, Utah.

PIZARRO COPPER MINING CO. **NEW MEXICO.**

Office: care of Financial Securities & Trust Co., Denver, Colo. Mine office: Silver City, Grant Co., N. M. Claims to have mining property in vicinity of Silver City. Is not favorably regarded.

PLAKALNITZA MEDNA PLANINA. **BULGARIA.**

Office: care of M. Mavrokordato, owner, Constantinople, Turkey. Mine office: Plakalnitza, Vratza, Bulgaria. Lands, sundry claims, held as a concession from the Bulgarian principality, showing bornite and a little chalcopyrite, in dolomite. Copper mines were worked in this vicinity by the Romans.

PLANET COPPER MINING CO. **ARIZONA.**

Office: 170 Broadway, New York. Branch office: 908 Equitable Bldg., Denver, Colo. Mine office: Planet, via Yucca, Yuma Co., Ariz. J. Stanley Jones, president; W. B. Storer, secretary; H. L. McCarn, superintendent. Organized August 14, 1902, under laws of Arizona, with capitalization $1,500,000, shares $10 par. City Trust Co., Boston, registrar. Company is free of debt.

Lands, 25 claims, area 500 acres, also 40 acres in millsites, in the Harcuvar district, on the south side of Bill Williams Fork river, 12 miles east of the Colorado river. Ore occurs in a metamorphic contact between diorite on the footwall and overlying sedimentary shales and impure limestone, much altered by intercalated eruptives, the vein carrying a heavy iron capping, mainly hematite, for a distance of circa 3,000′, averaging about 30′ thickness and up to 200′ in width. Apparently the hematite is of workable grade, and it is estimated that 500,000 tons of 60% iron ore are now exposed. Development is by 12 vertical shafts, of 20′ to 120′ depth, 3 incline shafts of 185′, 290′ and 325′, and 8 tunnels, longest 225′, showing an ore body averaging about 7% copper and 40% iron. The sulphide zone has not been reached, ores exposed being oxides, carbonate and silicates, none of the ores carrying important values in gold or silver. It is believed that a proper furnace mixture of ores can be secured from the mine, so that barren flux will not be necessary.

The mine, opened circa, 1864, was worked in a small way until 1874, and was again opened in 1884, when a 36″ blast-furnace was erected. Property was taken over, 1902, by present company, and has been developed steadily, with a

small force, since then. The property has produced upwards of $500,000 worth of high-grade ore, ranging from 15% to 40% in copper tenor, which was shipped by water to a port on the Gulf of California, presumably Guaymas, and trans-shipped thence to Swansea, Wales, for reduction. A little ore was sent to San Francisco also, and production is said to have given fair profits, notwithstanding the heavy expenses for freight and smelting, and the harassing difficulties caused by various Indian uprisings.

The property has been handicapped by distance from a railroad, but the Arizona & California railway line, now building west from Wickenburg, to the Colorado river, will pass within comparatively easy distance of the mine. The company plans sinking a new shaft of 500′ depth, to reach the ore zone proven by the incline shaft, and to facilitate extraction, and also plans beginning smelting operations, during 1906, having accumulated about a year's supply of ore for the proposed smelter.

PLATA COBRE MINING & TRANSPORTATION CO. **ARIZONA.**

Office: 415 Jackson Bldg., Denver, Colo. Mine office: Shultz, Pinal Co., Ariz. Wm. R. Benzie, president; John M. Shrote, secretary and treasurer; A. R. Benzie, superintendent. Lands include the Christmas Gift property, south of Casa Grande, bought September, 1903, ores of which carry silver, copper and gold. Idle and company apparently moribund.

PLATA COPPER MINING CO.

A swindle, promoted by the notorious Wm. F. Wernse gang, of St. Louis.

PLATTE CAÑON MINING CO. **WYOMING.**

Mine office: Wheatland, Laramie Co., Wyo. Presumably idle.

PLENTY COPPER CO. **ARIZONA.**

A swindle, promoted by the notorious Wm. F. Wernse gang, of St. Louis.

PLUMAS COPPER MINING & SMELTING CO. **CALIFORNIA.**

Letter returned unclaimed from former mine office, Susanville, Cal.

PLUMAS MINING, MILLING & SMELTING CO. **CALIFORNIA.**

Organized May, 1902, with capitalization $200,000, by A. Dragovich, et al, of San Francisco, to build a smelter at Taylorsville, Plumas county, California, but unknown at Taylorsville. Presumably dead.

PLUTO GOLD & COPPER MINING CO. **WYOMING.**

Office: 365 Tenth St., Oshkosh, Wis. Mine office: Dillon, Carbon Co., Wyo. Ole Granberg, president and general manager; H. Thorsgaard, vice-president; H. O. Granberg, secretary and treasurer; E. M. Sanders, superintendent; Frank Earle, engineer. Organized December 15, 1902, under laws of Wyoming, with capitalization $1,000,000, shares $1 par; issued, $909,735. Lands, 11 claims, patented, area 220 acres, also a 40-acre millsite, in the Battle Lake district, near the Ferris-Haggarty mine of the Penn-Wyoming Copper Co., showing 2 fissure veins in quartzite, and 2 contact veins between diorite and quartzite, ranging 2′ to 30′ in width, and carrying cuprite, melaconite and copper sulphides, associated with manganese, giving average assays of 1% copper and $3 gold per ton, with a trace of silver, developed by numerous pits of 10′ to 20′ depth, 5 shafts of 55′ to 100′ depth, and by a tunnel of 1,004′ with 2,000′ of underground workings. Equipment includes a 40-h. p. steam plant

and a 3-drill air-compressor. Buildings are a 36x40′ machine shop, 38x20′ carpenter shop, and 6 other mine structures. Company plans continuing development.

PLYMOUTH ROCK MINE. **CALIFORNIA.**

Mine office: Milton, Calaveras Co., Cal. T. T. Lane, owner. Ores carry gold, silver, lead and copper. Has water-power and a 10-stamp mill.

POCAHONTAS MINE. **CALIFORNIA.**

Office and mine: care of Mrs. Abby Waller, owner, Merced, Mariposa Co., Cal. Lands, 160 acres, showing several veins of cupriferous iron ore, between dioritic walls, vein matter being mainly diabase and altered diabase. Principal vein is about 100′ wide and the mineral belt is 1,000′ wide in places. Ore bodies, in lenses, are said to carry 6% to 12% copper and $2.50 gold per ton. Was a limited producer of high-grade carbonate and oxide ores, above the 100′ level, ore below being sulphide. Idle for some years.

POCATELLO GOLD & COPPER MINING CO. **IDAHO.**

Office and mine: Pocatello, Bannock Co., Idaho. E. Craanson, president; J. J. Guheen, secretary; N. M. Eldredge, general manager; Jos. E. Munn, superintendent. Organized Dec. 1, 1902, under laws of Idaho, with capitalization $1,000,000, shares 50 cents par. Lands, 7 claims, area 140 acres, including the Moonlight claim, in the Fort Hall district, 12 miles east of Pocatello, showing a vein of about 3′ average width, reported to give assays of 40% copper and 75% lead (total 115%) with 35 oz. silver and $1 gold per ton, from bornite and chalcopyrite. This evidently is very rich ore, as veins carrying 115% in metallic values are unusual. From another source it is gathered that the ore is mainly of milling grade, with a small paystreak of smelting ore, from which small shipments to the White Knob smelter have given returns of 17% to 30% copper, and 15 oz. to 18 oz. silver per ton. Development is mainly by short tunnels, with circa 1,000′ of workings.

MARTIN POE. **MEXICO.**

Office and mine: Autlán, Jalisco, Mexico. Lands include sundry properties in the vicinity of Autlán, among these being the Quitlitlán, 20 miles east of Chamela, area 30 pertenencias, showing a 30′ vein of argentiferous copper and lead sulphides, associated with hematite, developed by a 50-meter shaft, formerly worked for silver, of which some ore was exported to Europe, now idle, on account of water. The Refugio y Anexas, 6 miles west of Agua Blanca, area 5 pertenencias, show an 18′ vein of auriferous copper ore, opened by 120 meters of tunnels, and formerly were worked for gold. La Cucusiapa, area 4 pertenencias, shows a vein of 6′ to 8′ width, carrying argentiferous oxidized copper ores of $20 to $200 per ton value, opened by a shaft of 90 meters. La Anaconda, 6 miles east of Hacienda de Aguacopán, area 11 pertenencias, shows a 15′ vein carrying auriferous chalcopyrite, assaying 11% copper and $5 gold per ton, opened by a 150′ tunnel. The San José, 12 miles east of Autlán, area 40 pertenencias, shows a 6′ vein carrying auriferous and argentiferous copper ore, with some hematite, opened by a shallow shaft and short tunnel.

POGGIO GUARDIONE MINE. **ITALY.**

Owned by Societa Delle Capanne Vecchie e Poggio Bindo.

POLAND EXTENSION GOLD MINING & MILLING CO. **ARIZONA.**

Office: 401 Henne Blk., Los Angeles, Cal. Mine office: Poland, Yavapai Co, Ariz. Chas. J. George, president; M. C. Nichols, secretary; John G. Gray, superintendent. Ores carry copper, lead and zinc. Has steam power.

POLARIS MINING & MILLING CO. **ARIZONA.**

Office and mine: Clifton, Graham Co., Ariz. Employs 60 men. J. B. Schmitz, president; J. Porter Bender, vice-president; A. S. J. Eyler, secretary; L. S. Sweeting, manager. Company is said to have placed a bond issue, variously estimated at $750,000 to $1,000,000, with Colorado Springs parties, and, as near as can be ascertained, the International Mining Co. has agreed to furnish $75,000, in 3 years, for the development of the Polaris property.

Lands, 19 claims, lying northeast of the Clifton Consolidated and New England mines. Country rock is granite, with parallel intrusive porphyry dikes, showing contact veins carrying oxide, carbonate and altered sulphide ores, associated with gold-bearing quartz, with argillaceous gangue, lower workings showing auriferous and argentiferous chalcopyrite. Company is said to plan driving a 2-mile tunnel from a point near the San Francisco river, to cut the vein on the Polaris, at a depth of 2,000′, near the apex of Mount Greenlee. Company is said also to plan constructing an electric third-rail tram-line, from the mines to Clifton, 7 miles, and to plan building a smelter at Evans Point, on the San Francisco river. Equipment includes steam and gasoline power, and a 20-stamp mill. Property is considered promising.

PONDILLAI & VOLCAN GROUP. **NEW CALEDONIA.**

Letter returned unclaimed from former mine office, Diahot, New Caledonia.

PONTIAC GOLD & COPPER MINING CO. **NEW MEXICO.**

Letter returned unclaimed from former mine office, Tres Piedras, N. M.

PONTIAC MINING CO. **VIRGINIA & NORTH CAROLINA.**

Office: 19 Liberty St., New York. Mine office: Virgilina, Halifax Co., Va. A. A. Sumner, president; Samuel Bryant, secretary; Robt. G. Lassiter, general manager. Organized 1902, under laws of New York, with capitalization $1,600,000, shares $10 par. Lands, 1,340 acres, in the Virgilina district of Virginia and North Carolina, carrying a fissure vein in schist, opened by the Tuck shaft of 125′ and the Glasscock shaft of 203′, showing cuprite, malachite and azurite to depth of 60′, below which are chalcocite, bornite and chalcopyrite, with quartz and epidote gangue, giving average assays of 4% copper and 1 oz. to 2 oz. silver per ton, with traces of gold. Has gasoline power. Presumably idle.

POOLE GROUP. **ARIZONA.**

Letter returned unclaimed from former mine office, Washington, Santa Cruz Co., Ariz. Ores carry copper, gold, silver and lead.

POONA & MATTA DARRA MINES. **AUSTRALIA.**

Office: care of C. H. Hussey, Broken Hill Chambers, Adelaide, South Australia. Lands, 240 acres, adjoining the Moonta mine, on the Yorke Peninsula, South Australia. Has shafts of 120′ and 228′, showing rich ore in promising quantities. Presumably idle.

PORCUPINE MINE. **COLORADO.**

Office and mine: care of M. B. Sweeney, owner, Ashcroft, Colo.

PORCUPINE MOUNTAIN COPPER CO. **MICHIGAN.**

Office: Cleveland, Ohio. M. G. Watterson, president; E. S. Hough, secretary and treasurer. Was said to have been organized, 1901, under laws of New Jersey, with capitalization $2,500,000, but returns from Mr. Watterson give the ownership as vested in a syndicate, promoted 1890, with 7 shareholders, title being held by trustees. Lands 1,100 acres, well timbered, including a portion of the old Carp Lake mine, in the Porcupine Mountains, Ontonagon county, Michigan, showing a continuation of the Keweenawan copper belt, with intercalated amygdaloidal traps and conglomerate tuffs, with sandstone, showing sundry beds carrying native copper, disseminated as speiss, through sandstone. Property has 2 ore bodies, of 27′ estimated average width, with easterly and westerly strike and dip of 30° to the north, carrying estimated average values of 3% copper. Mine has circa 1,700′ of underground workings, estimated to show 150,000 to 200,000 tons of stamprock.

PORTAGE LAKE & BISBEE MINING CO. **ARIZONA.**

Office: 12 First National Bank Bldg., Hancock, Mich. Letter returned unclaimed from former mine office, Bisbee, Cochise Co., Ariz. W. S. Cleaves, president; John Funkey, vice-president; W. I. McMaster, secretary; Chas. Lewis, treasurer. Organized April, 1903, under laws of Arizona, with capitalization $1,000,000, shares $1 par, succeeding the Portage Lake & Calumet Development Co. Lands, 9 full and 3 fractional claims, area 191 acres, owned in fee and partly patented, 3 miles southeast of Bisbee, showing country rock of limestone, with a porphyry contact. Has a 302′ shaft, with two compartments, each 4′ 6″ square and well timbered. Has a small air-compressor, Worthington sinking pump, 75-h. p. hoist, boarding-house, bunk-house and smithy. Extensive diamond drilling was done, 1903-1904, and considerable leached ore cut, the showing, while not including workable ore bodies, being of an encouraging nature. Property is idle, and company practically out of funds.

PORTAGE LAKE & CALUMET DEVELOPMENT CO. **ARIZONA.**

Reorganized, April, 1903, as Portage Lake & Bisbee Mining Co.

PORTLAND COPPER CO. **WASHINGTON.**

Mine office: Berlin, King Co., Wash. Lands, sundry claims, 5 miles from Berlin and a railroad, showing a 17′ vein, with east and west strike, carrying native copper, bornite and chalcopyrite, opened by tunnels of 40′ and 75′.

PORTLAND COPPER MINING CO. **WYOMING.**

Succeeded by Battle Copper Mining Co.

PORTLAND GOLD & COPPER MINING CO. **WASHINGTON.**

Office: 7-127½ First St., Portland, Ore. Harvey Bailey, president and general manager; Conrad Wyss, vice-president; H. W. Bailey, secretary and treasurer; A. B. Burgoyne, general superintendent; preceding officers and Dr. R. D Wiswall, directors. Organized under laws of Washington, with capitalization $1,250,000, shares $1 par. Lands, 17 claims, area 340 acres, well

timbered, on the north fork of the Toutle river, in the Mount St. Helens district of Skamania county, Washington, having circa 300' of workings, showing ore giving good assay values in gold and copper.

PORTLAND-IMNAHA COPPER MINING CO.

Disincorporated, September, 1902, with all debts paid.

PORTLAND MINE. **WYOMING.**

Owned by Battle Copper Mining Co.

PORTLAND MINING CO. **BRITISH COLUMBIA.**

Office: 19 North Seventh St., Terre Haute, Ind. Mine office: Aspen Grove, Yale district, B. C. Andrew J. Crawford, president; M. T. Hidden, secretary; J. E. Bates, general manager. Organized 1901, under laws of British Columbia, with capitalization $15,000, shares 1 cent par. Lands, 4 patented claims, area 204 acres, also 160 acres miscellaneous lands, in the Aspen Grove district, showing 10 veins, of which 2, under development, give assays of 15% copper, 3 oz. silver and 80 cents gold per ton, from carbonate and sulphide ores, opened by a 155' shaft and 32' tunnel. Is said to show a considerable body of low-grade ore, worth $5 to $6 per ton. Idle, until rail connections can be secured.

PORTLAND (ROSSLAND) MINE, LTD. **BRITISH COLUMBIA.**

Merged, 1904, in Velvet-Portland Mine, Ltd.

PORVENIR DE SONORA CO. **MEXICO.**

Reorganized, 1902, as Coast Line Copper Co.

POSTAL GOLD, PLATINUM & COPPER MINING CO. **WYOMING.**

Moribund. Fully described in Vols. IV and V.

COMPAÑIA MINERA POTOSINA. **MEXICO.**

Office: Apartado 68, San Luis Potosí, S. L. P., Mex. Letter returned unclaimed from former mine office, Charcas, S. L. P., Mex. Property was the Guadalupe y Anexas mines.

MINA EL POTRILLO. **MEXICO.**

Mine office: Indé, Durango, Mexico. Victoriano Mantos, owner. Ores carry copper and silver. Has steam power.

NEGOCIACION MINERA DE POZOS. **MEXICO.**

Mine office: Pozos, Guanajuato, Mex. Operates Santa Brigida y Anexas, Santa Lucia and La Argentina mines, producing gold, silver and copper, latter as a by-product. Has steam power and employed several hundred men, at last accounts.

PRATT PYRITES MINES. **GEORGIA.**

Mine office: Dahlonega, Lumpkin Co., Ga. Ores are cupriferous and auriferous iron pyrites, carrying up to 2% copper and $2 gold per ton.

PRESIDENTIAL MINING CO. **ARIZONA.**

Mine office: Patagonia, Santa Cruz Co., Ariz. Ores carry silver, lead and copper. Presumably idle.

PRESTON PEAK COPPER CO. **CALIFORNIA.**

Presumably dead. Letters returned unclaimed from all offices. Described in Vol. V.

PRIDE MINING CO. **COLORADO.**

Dead. Formerly operated at Montezuma, Summit county, Colorado.

PRIDE OF ARIZONA COPPER CO. **ARIZONA.**

Dead. A Douglas-Lacey promotion—which is equivalent to terming it a swindle. Promoters, on January 30, 1904, reported property abandoned, but company's name still appears in New York and St. Louis city directories. For description of methods of Douglas, Lacey & Co., see Amalgamated Gold & Copper Co.

PRIDE OF THE WEST MINING & MILLING CO. **ARIZONA.**

Office: 1801 Fifteenth St., Denver Colo. Letter returned unclaimed from former mine office, Washington, Santa Cruz Co., Ariz. Arthur R. Wilfley, president; Herbert E. Fiske, secretary. Organized May 1, 1901, under laws of Colorado, with capitalization $1,500,000, shares $10 par. Paid one dividend, of $15,000. Lands, circa 350 acres. Mine was opened 1870, reopened 1897, closed 1902, since idle. Main shaft, about 300′. Ores carry silver, copper, lead and zinc. Has a 200-ton concentrator. Fully described in Volumes II and III.

PRINCE MINING & DEVELOPMENT CO., LTD. **BRITISH COLUMBIA.**

Office: Revelstoke, B. C. Mine office: Standard Basin, Big Bend division, West Kootenay district, B. C. W. M. Brown, chairman; J. M. Scott, secretary and general manager; C. J. Rumens, superintendent; preceding officers, Jerry Culbertson and Dr. S. A. Delameter, directors. Organized 1900, under laws of British Columbia, with capitalization $1,000,000, shares $1 par; issued, $770,000. Annual meeting, second Wednesday in March.

Lands, 20 claims, area 800 acres, known as the Standard group, also a 480-acre millsite and 640 acres timber lands, giving total holdings of 1,920 acres, in the Revelstoke district. Country rocks are banded schist and diorite, carrying chalcopyrite and bornite, in a vein of 20′ width, with gangue of serpentine and argillaceous schist, ore being estimated to carry average values of 6% copper, 2 oz. silver and $2 gold per ton. Development is by tunnels of 40′, 110′, 480′, 600′, 275′, and 720′, with circa 3,000′ of underground workings, estimated to show 150,000 tons of ore, with 100,000 tons blocked out for stoping. A good water power is available for mining and milling purposes .The property has not reached yet the producing stage, and needs a tram-line and mill, but gives promise of making a good mine.

PRINCESS ADA MINE. **WASHINGTON.**

Office and mine: Marcus, Stevens Co., Wash. Chas. H. Alban, owner.

PRINCESS ROYAL GOLD & COPPER MINING CO. **BRITISH COLUMBIA.**

Office: New Whatcom, Wash. Henry W. Parrot, president; Samuel D. Slentz, secretary. Lands, sundry claims, on Princess Royal Island, ores from which have given assays very high in copper, with $4 to $10 gold per ton. Idle.

PRINCESS ROYAL GROUP. **BRITISH COLUMBIA.**

Office: care of Capt. John Irving, Victoria, B. C. Lands, 120 acres, showing a 4′ vein with 18″ to 24″ paystreak carrying auriferous and argentiferous copper ores that have returned smelter values up to $120 per ton. Idle.

PRINCETON COPPER MINING & SMELTING CO. **ARIZONA.**

Office: 171 Broadway, New York. Mine office: Ft. Huachuca, Cochise Co., Ariz. Henry Hamburg, president and general manager; Jas. W. Herale, vice-president; Wm. T. Huguley, secretary and treasurer; preceding officers, J. M. O'Connell and L. de Vere Hamburg, directors. Organized 1901, under laws of South Dakota, with capitalization $2,500,000, shares $1 par. Lands, 8 claims, well timbered, in Ramsey Cañon, Hartford district, Huachuca Mountains, opened by 4 shafts, deepest 80′, and by tunnels of 60′, 70′, 115′ and 250′, with a quarter-mile of underground workings, showing malachite, chalcocite and bornite, giving assays of 10% and upwards in copper, 10 oz. to 50 oz. silver, and small gold values. Property was opened, circa 1880, by Ben Williams. Work was discontinued June, 1905, and property was idle at last accounts. Financial affairs were in a tangle, October, 1905, but are said to have been straightened out.

PRODIGAL SON MINE. **CALIFORNIA.**

Letter returned unclaimed from former mine office, Cayucos, San Luis Obispo Co., Cal. Has limited development by shaft and tunnel, showing a vein of about 7′, traversing syenite and serpentine and carrying auriferous and argentiferous chalcocite, with quartz gangue.

PRODUCER GOLD & COPPER MINING & MILLING CO. **WYOMING.**

Mine office: Encampment, Carbon Co., Wyo. Capitalization $3,000,000, shares $1 par. Lands, 12 claims, on Copper Mountain, slightly developed. Equipment includes an air-compressor and a mill with 10 gravity stamps.

PRODUCER MINING & SMELTING CO. **ARIZONA.**

Office: 510-125 La Salle St., Chicago, Ills. Mine office: Casa Grande, Pinal Co., Ariz. J. W. McCoy, president; E. R. Zimmerman, secretary. Lands were the Jack Rabbit group of 80 acres, in Pinal county, the Producer and Century-Chief group of 320 acres and the Index group of 220 acres in Pima county, Arizona. Lands, in the Quijotoa Mountains, were held under $30,000 bond and lease, on which $14,000 was paid before company learned that vendors lacked proper title. Main shaft, 200′, with about ½ mile of underground openings, is said to show 52,000 tons of auriferous and argentiferous copper ore. Presumably idle.

MINA LA PROFUNDA. **SPAIN.**

Mine office: care of Don Ruperto Sanz, León, León, Spain. Lands include La Profunda, Cármenes and one other mine, which were working, on a small scale, at last accounts.

MINA EL PROGRESO. **MEXICO.**

Mine office: care of A. E. Turner, owner, Sabinal, Chihuahua, Mex. Ores carry silver, copper and lead. Has steam power.

MINA PROMONTORIO. **MEXICO.**

A copper-gold property, northwest of the city of Durango, Durango, Mexico, said to be owned by an Anglo-German company, and said to have large ore bodies. Erected a 100-ton concentrator and small matting furnace, circa 1902. Presumably idle.

PROMONTORIO CONSOLIDATED MINING CO. **MEXICO.**

Office: Nogales, Ariz. Leopold Ephraim, president; R. D. George, secretary. Lands are circa 30 miles south of Nogales, in the Arizpe district of Sonora, Mexico. Ores are lead and copper sulphides, with gold and silver values. Was worked for about 12 years, by Mr. Ephraim, before formation of present company, high-grade ores being shipped to El Paso smelters and low-grade ores accumulated on dumps. Later developments have not come up to expectations.

PROMONTORIO MINING & SMELTING CO. **MEXICO.**

Dead. Property, near Lampasos, Moctezuma, Sonora, Mexico, now held by Travers-Durkee Coppers.

PRO PATRIA MINING & MILLING CO. **COLORADO.**

Mine office: Rico, Dolores Co., Colo. W. J. Scoutt, superintendent. Ores carry gold, silver, lead and copper. Has water and electric power and a 50-ton concentrator.

PROSPER GOLD MINING CO. **NEW MEXICO.**

Mine office: Hillsboro, Sierra Co., N. M. Ores carry gold, silver and copper. Has steam power. Presumably idle.

MINA PROTECTARO. **MEXICO.**

Office and mine: care of F. B. Najara y Ca., owners, Topia, Durango, Mex. Ores carry gold, silver and copper. Employed circa 50 men, at last accounts.

PROVIDENCE GOLD & COPPER CO. **CALIFORNIA.**

Office: 617 Homer Laughlin Bldg., Los Angeles, Cal. Mine office: Goldstone Camp, via Kelso, San Bernardino Co., Cal. Employs 8 men. P. H. Mathews, president; W. E. Baxter, vice-president; F. H. Messmore, auditor; A. Samuel Parks, secretary; preceding officers, C. M. Wood and Jas. H. Dewey, directors; C. J. Callahan, consulting engineer. Organized November 2, 1901, under laws of Arizona, with capitalization $3,000,000, shares $1 par; issued, $1,776,789. Pays current accounts monthly, and is without debt. Annual meeting, first Monday in November.

Lands, 15 claims and 8 millsites, area 340 acres, patents applied for, in the unorganized Arrow district, showing 15 fissure veins, carrying sulphide ores, assaying circa 1% copper and $4 to $1,000 gold per ton, with small silver values. Has several shafts, all under 100′, with a total of 2,100′ of underground openings. Will continue development work during 1906. Management is good and property considered promising.

PROVIDENCE GOLD, SILVER & COPPER MINING CO. **ARIZONA.**

Was organized by the joint efforts of Fanny Pogue, a colored woman of Tucson, Arizona, Walter M. Roberts, of St. Louis, and others. Is a twin of the United Copper Mining Co., and apparently claims some ground that already is claimed by several sets of Lincoln mining companies. In this case it might not be wise to put too much trust in Providence.

MINA LA PROVIDENCIA. **MEXICO.**

Mine office: Gavilanes, Durango, Mex. Anastasio Lugo, owner and manager. Has a 130′ main shaft, developing argentiferous copper ores. Has water power, and employed circa 40 men, at last accounts.

PROVIDENCIA MINES CO. **MEXICO.**

Mine office: Cosalá, Sinaloa, Mexico. E. A. Stent, manager. Organized circa 1906, with capitalization $500,000, to operate the Campanillas mines.

PROVIDENCE MINING CO., LTD. **BRITISH COLUMBIA.**

Office: care of J. B. Heeny, secretary and treasurer, Chicago, Ills. Mine office: Greenwood, Yale District, B. C. M. S. Madden, president; D. B. Scully, vice-president P. J. Dermody, superintendent. Mine carries principally gold values. Statement, at last annual meeting, showed a balance of cash assets of $42,290.24, and a profit, on 1905 operations, of $19,034.76. A quarrel between the Chicago and local interests resulted in some litigation, in which the Chicago men were successful.

PRUDENTIAL COPPER MINING CO. **ARIZONA.**

Office: care of Shea Smith, president, 18 Custom House Pl., Chicago, Ills. Letter returned unclaimed from former mine office, Prescott, Yavapai Co., Ariz. E. A. Haggott, consulting engineer. Idle.

PRUDENTIAL MINING CO. **CALIFORNIA.**

Office: care of H. S. Reed, manager, Medford, Ore. Lands, near Shelly Creek, Del Norte county, California, are slightly developed by shaft and tunnel, showing 2 veins of 25′ to 30′ width. Ore is pyrrhotite, carrying copper, gold, silver and zinc, in small percentages. Idle at last accounts.

PRUDENTIAL MINING & DEVELOPMENT CO. **ARIZONA.**

Letters returned unclaimed from former mine office, Nogales, Santa Cruz Co., Ariz. Lands were 12 claims, adjoining the Buena Vista group of the Black Mountain Mining Co.

PSYCHE MINING CO. **OREGON.**

Office: Omaha, Neb. Mine office: Greenhorn, Baker Co., Ore. J. Fawcett, manager. Ores carry gold, silver and copper. Has steam power and a 20-stamp mill.

PTARMIGAN GROUP. **BRITISH COLUMBIA.**

Sundry claims at the head of McDonald creek, an affluent of Horse Thief creek, East Kootenay, British Columbia, showing slightly auriferous and highly argentiferous copper ores, claimed to be opened by about 3,000′ of tunnels and drifts.

PUERTECITO COPPER CO. **MEXICO.**

Succeeded the Sonora Copper Co. Assets consist of a lawsuit against Col. Wm. C. Greene.

PUGET SOUND COPPER MINES. **BRITISH COLUMBIA.**

Mine office: Van Anda, Texada Island, B. C. Has a copper ore body, with heavy gossan capping of fair-grade iron ore. Presumably idle.

PUGET SOUND INVESTMENT CO. **BRITISH COLUMBIA.**

Letter returned unclaimed from former office, Irondale, Wash. Had copper claims near Gillies Bay, Texada Island, British Columbia.

PUGET SOUND REDUCTION CO. **WASHINGTON.**

Control passed, 1905, to American Smelters Securities Co.

PUGWASH CONSOLIDATED MINING & SMELTING CO. **NOVA SCOTIA.**

Letter returned unclaimed from former office, 50 Congress St., Boston

Mass. H. H. Mansfield, treasurer. Company succeeded the Pugwash River Copper Co., which held 320 acres of land on the upper Pugwash river, Cumberland county, Nova Scotia. Property is said to show chalcocite in sandstone. Idle.

PUGWASH RIVER COPPER CO. **NOVA SCOTIA.**

Succeeded, circa 1904, by Pugwash Consolidated Mining & Smelting Co.

PULIDO MINING CO., LTD. **PORTUGAL.**

Offices: 5, Great Winchester St., London, E. C., Eng. J. Silva, chairman; C. E. Wilkey, secretary. Capitalization, £165,000. Lands, 22 mineral concessions, in the Beja district, province of Alemtejo, Portugal. Moribund.

COMPAÑIA DE MINAS y FUNDICION DE PUQUIOS. **CHILE.**

Mine office: Los Puquios, Rancagua, Chile. Operates the Santa Rita, Ricardita, Morada and Magdalena mines, opened 1897, upon a considerable scale. Has steam power and a smelter, employing several hundred men.

PURITAN COPPER & GOLD MINING CO. **NEW MEXICO.**

A swindle, promoted by Benj. F. Coburn, of Boston, who "guaranteed" 10% dividends for 5 years.

PYNE SMELTING CO. **CALIFORNIA.**

Office: 26 First National Bank Bldg., San Francisco, Cal. Works office: West Alameda, Alameda Co., Cal. P. W. Pyne, manager. Works have a daily capacity of 100 tons. Idle since 1903, having been closed by courts, on complaints of gardeners in vicinity that fumes injured vegetation.

PYRAMID COPPER CO.

Organized, 1902, under laws of Maine, with capitalization $500,000, with $300 paid in. Presumably dead.

PYRAMID COPPER SYNDICATE, LTD. **BRITISH COLUMBIA.**

Dissolved, August, 1905.

PYRAMID GOLD & COPPER MINING CO. **ARIZONA.**

Moribund. W. H. Ruffhead, the president, says that every last one of his associates was a shark. Mr. Ruffhead is accused, in turn, of having become involved in illegal transactions, to the company's undoing. Fully described in Vol. V.

PYRAMID PEAK MINING CO. **NEW MEXICO.**

Mine office: Lordsburg, Grant Co., N. M. Company held the Nellie Bly claim, under a $25,000 option, but surrendered same December, 1905, and apparently has lost its life, as well as its property.

PYRENEES COPPER MINES, LTD. **FRANCE.**

Dissolved, August, 1904.

PYRENEES MINERALS, LTD. **FRANCE.**

Offices: 60, King St., Manchester, Eng. W. Dearden, secretary; Isidore Tom, mine manager. Organized May 5, 1902, with capitalization £160,000, shares £1 par; issued, £98,207. Debentures, £60,000, at 6%. Lands, 1,818 acres, including the Alzen silver and copper mines, in the department of Ariege, France. Has a 20-ton smelter. Idle and presumably moribund.

PYRITE KING COPPER MINING CO. **SOUTH DAKOTA.**

Office: Pipestone, Minn. Lands are in the Black Hills, South Dakota. Idle.

PYTHON GROUP. **BRITISH COLUMBIA.**

Mine office: Kamloops, Yale district, B. C. Idle.

"Q" COPPER SYNDICATE, LTD.

Offices: Worcester House, Walbrook, London, E. C., Eng. Organized Nov. 29, 1905, with capitalization £10,000, in 5,000 preference £1 shares and 50,000 ordinary 2s. shares.

Q. S. GOLD MINING & SMELTING CO. **WASHINGTON.**

Office: 640 Hyde Blk., Spokane, Wash. Mine office: Camp Q. S., via Conconully, Okanogan Co., Wash. Employs 6 men. A. M. Dewey, president and general manager; F. S. Beavis, vice-president; F. S. Merrill, secretary; Samuel Crow, treasurer; F. Moritz, superintendent; L. K. Armstrong, consulting engineer. Organized 1897, under laws of Washington, with capitalization $2,000,000, shares $1 par.

Lands, 18 claims, area 360 acres, also 600 acres in millsites, in the Salmon district. Country rock is mainly diorite, carrying several fissure veins, of which one, developed by a 120′ tunnel, is of 150′ estimated width, traceable 1,500′ on surface, carrying chalcopyrite of uncertain grade, estimated at better than 2% copper, with small and variable silver values and $1 and upwards gold per ton. The tunnel is expected to crosscut the vein at a further distance of about 300′, giving a 600′ back.

QUARTETTE MINING CO. **NEVADA.**

Office: 1016 Old South Bldg., Boston, Mass. Mine office: Searchlight, Lincoln Co., Nev. Geo. G. Crocker, president; Andrew N. Creston, vice-president; Chas. A. Hopkins, treasurer; Geo B. Drake, secretary; F. B. Harrington, superintendent; James Luxton, mine superintendent; Paul Johnson, mill superintendent. Property is primarily a largely productive gold mine, carrying a little copper ore, said in the press to have $9,000,000 worth of free milling gold ore blocked out. Has steam and gasoline power, 35-stamp mill and 100-ton cyanide plant, employing 75 to 100 men, and pays 6% dividends.

QUEBEC COPPER CO., LTD. **BRITISH COLUMBIA.**

Letter returned unclaimed from former mine office, Deadwood, B. C.

LA QUEBRADA GROUP. **VENZUELA.**

Includes the principal mines of the Quebrada or Aroa district of Venezuela, which have produced about 60,000 tons of fine copper. Group includes the Cumuragua mine, having a vein of carbonate ore 1′ to 5′ wide; the Titiara mine, with vein 2′ to 25′ wide; the San Antonio mine, with vein of 3′ to 18′, and the Quebrada mine, with a vein 50′ to 75′ wide, 2,000′ long and of unknown depth, from which oxide and carbonate ore have been mined in the alteration zone, leaving a large body of sulphide ore, averaging possibly 5% to 6% copper, in the lower workings. This group is one of great importance, but owing to the extremely unsettled political conditions in Venezuela, capital cannot be induced to consider the reopening of the mines.

QUEEN BEE COPPER MINING CO.

Letter returned unclaimed from former office, 220 Broadway, New York.

QUEEN BEE MINE. **ARIZONA.**

Mine office: Kingman, Mohave Co., Ariz. Lands include the White Copper mine. Presumably idle.

QUEEN BEE MINING CO. **AUSTRALIA.**

Mine office: Cobar, Robinson Co., N. S. W., Australia. At last accounts was developing claims in the Bee Mountains, 11 miles southeast of Cobar, said to show a 50′ vein, giving assays up to 45 % copper, with fair gold and silver values.

QUEEN MINING & MILLING CO. **NEW MEXICO.**

Office: care of H. A. Griffin, secretary, Galveston, Texas. Mine office: Cooney, Socorro Co., N. M. Organized under laws of Texas. Lands, 5 claims, known as the Copper Queen group, showing good bodies of low grade gold-silver-copper ores, developed by about 3,000′ of underground workings. Has steam power and a 15-stamp pan-amalgamation mill.

QUEEN OF ARIZONA COPPER CO. **ARIZONA.**

Merged, 1902, in Great Belcher-Bullwhacker Gold Mining Co.

QUEEN OF THE WEST MINING CO. **COLORADO.**

Mine office: Central City, Gilpin Co., Colo. L. C. Moe, superintendent, at last accounts. Ores carry gold, silver and copper. Has steam power.

QUEENSLAND COPPER CO., LTD. **AUSTRALIA.**

Offices: 6, Princes St., London, E. C., Eng. Mine office: Mt. Perry, Bowen Co., Queensland, Australia. Geo. Grinnell-Milne, chairman; J. D. Audley Smith, mine manager; Sydney H. Pulbrook, superintendent; J. S. MacArthur, consulting engineer; J. G. Tait, secretary. Organized Feb. 1, 1898, with capitalization £500,000, shares £1 par, in £250,000 cumulative 6% preference shares and £250,000 ordinary shares. After payment of 6% on ordinary shares in any year, remaining profits are divisible equally between preference and ordinary shares. Last dividend on ordinary shares was 6%, in 1903. For fiscal year 1905, profit was £12,756 2s. 11d.

Lands include the Mount Perry, Reed's Creek, Great Freehold and New Moonta mines, and the Normanby mine, held under a two years' option expiring June, 1907, in the vicinity of Mt. Perry, in the Herberton district. The three principal mines of the company have 15 shafts, of 120′ to 800′ depth. The company also works various mines in the Wolca and Boolboonda districts.

The Mt. Perry mine has sundry fissure veins traversing granite, the main vein, of about 12′ average width, having a paystreak of 6″ to 8″ width in the upper levels and 10″ width in the lower levels, carrying an average of circa 16% copper. The mine is opened by 3 old shafts, poorly located and inadequate. The management plans sinking a new main working shaft, between Kennedy's shaft and the South shaft, which would cut the vein at a depth of circa 1,000′. The ground has grown harder with depth, and the extra cost of operating deep workings renders a new and modern shaft necessary.

The Great Freehold mine, area 811 acres, has a nearly vertical fissure vein in granite, averaging 5′ width, with an 18″ paystreak, carrying, chal-

copyrite averaging circa 14% copper, with fair gold and silver values, developed by a 200' main shaft.

The Reed's Creek mine has a fissure vein in granite, similar to that of the Mt. Perry, and is extensively developed, but the shafts are small and poorly located for modern mining requirements. Combined area of the Mt. Perry and Reed's Creek mines is 650 acres, freehold.

The New Moonta is a comparatively new mine, much similar to those previously described, from which about 2,000 tons of high-grade ore were mined in 1905, and is considered a promising property, recent developments having given promise of the mine holding good values to depth.

The Normanby mine, held under option, is 240 acres, freehold, on the other side of the mountain from the Mt. Perry mine, with a vein paralleling the same, and of a similar nature. This property produces ore averaging circa 13% copper and 10 dwts. to 15 dwts. gold per ton.

In addition to the mines of the Mt. Perry district, the company works the Greenback, Potosi and Wolca mines, in the Wolca district, northeast of Mt. Perry, and the Edena and Boolboonda mines, in the Boolboonda district, northeast of the Wolca district. The veins of these latter properties are narrow, but persistent, and carry high-grade auriferous and argentiferous copper ores.

The smelter, at Mt. Perry, built 1902, has one 40-ton and one 90-ton water-jacket blast-furnace, and it is planned to install a converter plant. The smelter is connected with the principal mines by a tram-line, and also does custom smelting. The smelter is rated, by the company, at only 50 tons daily capacity.

For the fiscal year 1905, the furnace smelted 10,388 long tons of ore, about 25% of which was custom ore, producing therefrom 2,952,320 lbs. fine copper, 74,395 oz. silver and 2,055 oz. gold. The property has proven somewhat disappointing, possibly because the hopes originally entertained were based upon an imperfect understanding of the circumstances, but the outlook seems better, and with a maintenance of high copper prices for another year or two, and the opening of new shafts, the property should get upon its feet.

QUEENSLAND MINES EXPLORATION CO. **AUSTRALIA.**

Dead. Very dead. Samuel Phillips says, dead as Mahomet's black dog.

QUEENSLAND PIONEERS, LTD. **AUSTRALIA.**

Voluntarily liquidated, February, 1902.

QUEENSLAND SMELTING CO., LTD. **AUSTRALIA.**

Offices: Dashwood House, London, E. C., Eng. Works office: Aldershot, Maryborough, Queensland, Australia. Chas. Poston, chairman; Arthur Kift, secretary and managing director. Organized Jan. 3, 1899, as reconstruction of a company of same name organized 1888, with capitalization £50,000, in £30,000 cumulative 5% preference shares and £20,000 ordinary shares: issued, £38,630. Debentures, £65,000 authorized, £43,800 issued, in £100 bonds, at 5%. Paid a 5% dividend, on pref-

erence shares, 1903. Property is 1,168 acres, freehold, with a smelting plant having furnaces for reduction of copper, gold, silver and lead ores.

QUEEN VICTORIA MINE. **BRITISH COLUMBIA.**

Letter returned unclaimed from former mine office, Beasley Camp, via Nelson, Kootenay district, B. C. Has a big bluff of copper ore, claimed to be 300′ wide and 400′ long, with rhyolite walls, slightly developed. Idle for several years.

QUICKSILVER MINES, (CALIFORNIA, U. S. A.) LTD. **CALIFORNIA & OREGON.**

Dissolved, August, 1904.

COMPAÑIA EXPLOTADORA DE LA MINA DE COBRE QUILILLA. **MEXICO.**

Office: Scranton, Pa. Mine office: Ameca, Jalisco, Mex. Chas. S. Weston, president; John W. Fowler, secretary and treasurer; Independence Grove, general manager; Felix Orozco, superintendent. Lands, 50 pertenencias, area 123 acres, in the Ameca district of Guachinango, showing 2 fissure veins in porphyry, of which one, averaging 4′ to 6′ width, is opened by 5 shafts, of 40′ to 190′ depth, and by 5 tunnels, longest 460′, with about 1,500′ of underground workings. Ores give average assays of about 9% copper, 10 oz. to 25 oz. silver and $3 gold per ton.

QUINCY & ARIZONA DEVELOPMENT CO. **ARIZONA.**

Office: care of N. A. Metz, secretary and treasurer, Hancock, Mich. Letter returned unclaimed from former mine office, Bisbee, Cochise Co., Ariz. J. J. Beatty, president; Geo. Keller, superintendent. Capitalization $600,000, shares $10 par. Lands, 12 claims, adjoining the Portage Lake & Bisbee. Idle and presumably moribund.

QUINCY MINING CO. **MICHIGAN.**

Office: 32 Broadway, New York. Mine and works office: Hancock, Houghton Co., Mich. Employs 1,704 men. Wm. R. Todd, president; Walter P. Bliss, vice-president; preceding officers, Cleveland H. Dodge, James L. Bishop, Chas. J. Devereaux, Isaac H. Meserve, Daniel T. Brigham and Hon. Don M. Dickinson, directors; W. A. O. Paul, secretary and treasurer; Chas. L. Lawton, superintendent; Jas. W. Shields, mill superintendent; Will P. Smith, smelter superintendent; Thos. Whittle, mining captain; Chas. K. Hitchcock, Jr., engineer; F. J. McLain, mine clerk; Wm. Bath, smelter clerk; Walter Bloomfield, purchasing agent; Wm. Gililland, master mechanic.

Official returns to the state of Michigan, as of date Jan. 1, 1905, disclose the following figures:

Amount of cash paid in on capital stock	$1,500,000.00
Amount paid in by conveyance of property	1,000,000.00
Amount of personal estate	966,474.41
Amount of floating debt	286,951.40
Amount due company	267,318.30

llowing table shows statistics of production, costs, etc., since 1864·

Product. Pounds.	Yield fine copper per fathom broken. Pounds.	Price obtained. Cents.	Cost per pound exclusive of construction. Cents.	Number of miners.	Average monthly contract wages.
.....2,498,574	562	44.8	26.7	242	$65.50
.....2,720,980	501	....	....	212	57.53
.....2,114,220	451	31.3	29.0	227	53.16
.....1,921,620	526	22.7	18.9	167	50.83
.....1,417,941	447	25.2	23.1	157	50.44
.....2,417,365	446	21.9	16.7	210	51.10
.....2,496,774	528	21.5	15.3	181	46.09
.....2,409,501	441	22.8	15.2	104	47.08
.....2,269,104	391	32.5	22.9	233	60.62
.....2,621,087	491	26.5	18.6	223	62.40
.....3,050,154	577	21.9	15.1	234	43.38
.....2,798,281	485	22.7	15.8	217	46.74
.....3,073,171	507	20.0	15.7	227	47.13
.....2,837,014	467	18.6	15.1	247	43.79
.....2,991,050	395	14.9	14.0	234	41.50
.....2,639,958	403	16.3	13.7	212	38.76
.....3,609,250	563	18.5	11.8	192	49.10
.....5,702,606	766	18.7	10.6	212	48.54
.....5,682,663	800	17.1	9.5	152	48.83
.....6,012,239	850	13.7	8.9	165	46.02
.....5,680,087	722	12.2	8.6	157	43.35
.....5,848,497	710	11.4	7.5	132	44.00
.....5,888,517	638	11.1	6.8	140	45.80
.....5,603,691	781	11.7	8.6	142	48.40
.....6,367,809	690	15.9	10.1	158	49.60
.....6,405,686	690	12.0	9.4	145	49.15
.....8,064,253	769	15.7	8.2	146	52.60
.....10,542,519	685	12.8	9.1	182	53.40
.....11,103,926	572	11.2	8.8	238	53.75
.....14,398,477	574	10.4	7.1	259	49.60
.....15,484,014	584	9.5	5.7	285	50.70
.....16,304,721	517	10.1	5.9	336	50.00
.....16,863,477	477	10.9	6.5	379	52.00
.....16,924,618	481	11.1	6.8	393	52.52
.....16,354,061	513	12.0	6.8	381	52.50
.....14,301,182	427	17.0	8.1	401	56.72
.....14,116,551	391	16.6	9.3	433	62.00
.....20,540,720	409	16.1	8.8	533	62.00
....18,988,491	347	11.9	9.0	562	62.00
....18,498,288	325	13.2	9.7	586	62 00
....18,343,160	307	13.3	9.7	592	62.40
....18,827,557	277	15 8	10.1	643	65.10

in February, 1906. There seems reason to fear that these troubles will be a concomitant of the deep-level operations of the Quincy, in the older workings, for the balance of the mine's history.

Owing to the absorption of the Pewabic and Mesnard mines, shafts are numbered irregularly. The southernmost is No. 7, of 5,162′ depth, to the 59th level; 860 next north is No. 4, which is 4,186′ deep, to the 51st level; 585′ next north is No. 2, which is 5,289′ deep, to the 61st level, being more than one mile in depth, and the deepest in the Lake Superior district, outside of the Calumet & Hecla and Tamarack mines; 1,928′ next north is No. 6, which is 5,255′ deep, to the 60th level, and 4,168′ north is No. 8, the Mesnard shaft, 3,354′ deep, to the 24th level, corresponding to the 42d level of No. 6. Extreme distance is 7,541′ between No. 7 and No. 8 shafts, the Franklin mine intervening between shafts Nos. 6 and 8.

No. 7 shaft, planned and sunk by Mr. John L. Harris, is on a catenary curve, leaving surface at an angle of 53°, but bottomed at about 37° 30′. The shaft was sunk 4,000′ in 18 months, through exceedingly refractory rock, this speed being made possible by sinking and raising in 5 sections, simultaneously. The steel shaft-rockhouse is 100′ high, with large wings, fitted with a steam-hammer and 5 Hodge crushers. This shaft has an 8,000-h. p. Allis-Chalmers Corliss hoist, with 52x84″ cylinders, and winding drums 28′ in diameter by 11′ 9″ face, carrying 8,000′ of 1½″ steel cable, capable of raising 6-ton skips from a depth of 1½ miles, at a speed of 3,000′ per minute, hoisting being limited to this rate by an automatic cut-off, which also prevents over-winding. Starting a load of 6 tons from a depth of nearly one mile, the hoist, if untouched, will check, without damage, after raising the skip a few feet higher than the appointed place in the shafthouse. The main shaft carrying the drum weighs 60 tons. The engine-house is 58x94′, with a 56x92′ boiler-house adjoining, both of stone, with steel truss roofs. This shaft produces about 1,000 tons of rock daily, or approximately 30% of the total output of the mine.

The stoping ground tributary to No. 4 shaft being nearly exhausted, and as a new hoist would be required for greater depth, and the lower stretches of ground tributary to No. 4 can be reached easily from No. 7 by electric trams, it was planned to abandon No. 4 and raise the water heretofore forked from No. 4 through shafts Nos. 2, 6 and 7, these having 1,300-gallon bailers for the purpose. Previous to abandoning the shaft, a more systematic attempt was made to develop payable ground on the West Lode. This has been successful, to the point of opening several years reserves of stoping ground that will yield a profit with copper at 15 cents per pound, or better, but this ground probably would be unpayable at a lower price for the metal. The value of the West Lode, however, is very great, to a mine so circumstanced as the Quincy ,which has ample facilities for treating the very lowest grade of stamp-rock that can be worked at a profit, with need for opening new ore reserves. The West Lode is not likely to prove a bonanza, at any point, but it is likely to yield many millions of pounds of copper, secured at some sort of a profit, which, in this case, will mean a net profit. Surface

equipment at No. 4 shaft includes air-compressors of 40 drills aggregate capacity.

The surface equipment at No. 2 shaft is practically a duplicate of that at No. 7, including two 60-drill air-compressors.

No. 6 shaft is only 200′ south of the boundary line of the Quincy and Franklin mines, and production will be somewhat decreased, owing to No. 8 taking considerable ground heretofore tributary to No. 6, under the Franklin mine. No. 6 has an Allis-Chalmers duplex hoist with a 22′ 6″ straight-face drum raising 8-ton skips. The power-house has a centrifugal feed-water heater attached to one cylinder of the duplex hoist. The air-compressor at No. 6 has been remodeled to a two-stage compound engine, increasing its capacity to 100 power drills.

No. 8 shaft, on the Mesnard tract, showed poorly in the upper levels, but the lower workings, while by no means up to the old Quincy average, in either quantity or quality of rock developed, show a wider and better mineralized lode than above, and of satisfactory grade, as the mine now averages. The improvement began with the 10th level, and from the 20th level downward the shaft develops productive ground nearly or quite up to the present average of the old Quincy and Pewabic workings, the best ground being shown to the southward, which is not altogether encouraging for the mile of undeveloped ground in the Mesnard and Pontiac tracts, to the northward, toward the Franklin Junior mine. Levels in No. 8 are opened uniformly at distances of 135′, and the connection between No. 6 and 8 shafts, secured July 15, 1906, is on the 24th level of No. 8 and the 42d level of No. 6, at a depth of 3,354′ from surface. This level passes underneath the entire workings of the old Franklin mine, which was estopped by its boundry lines from following the Pewabic lode to greater depth. No. 8, at the end of 1905, was producing circa 400 tons of stamp-rock daily, to be increased to 1,000 tons per diem, when the new equipment permits the hoisting of a heavier tonnage.

The permanent plant at No. 8 includes a shaft-rockhouse similar in design and equipment to those at Nos. 2 and 6, with a structural steel addition, building in 1906, that will increase the capacity to at least 1,200 tons daily. The new power plant is under one roof, in a building 52x140′, with a 9′ basement under the engine-room. The old hoist, good for 4,000′ only, is to be replaced by a permanent Nordberg hoist, with 32x72″ duplex cylinders, and double conical drum with 12′ 6″ minimum and 18′ 6″ maximum diameter, good for 6,000′ depth. The boiler-room has 3 Burt locomotive firebox boilers, with room for 3 more. The smokestack, of 140′ height, on a 15′ base, is of steel-reinforced concrete. The power plant has extensive coal-bunkers under the same roof, with direct rail connection over a trestle.

At the shaft-rockhouses the stamp-rock is dumped from the skips, as hoisted, upon grizzlies of 2″ steel bars, placed 2″ apart, at an angle of 45° in an upper section, with a lower section at 20° only, in which bars are 12″ apart from center to center, the combination grizzly assorting rock automatically into two grades, the fine stuff going to ore-bins and the coarse falling into two chutes, receiving equal portions, which feed direct to two rock-crushers

MINA DE RAMOS. **MEXICO.**

Office: care of D. E. Murphy, lessee, Aguascalientes, Mex. Mine office: Ramos, San Luis Potosí, Mex. Francis H. Sisterman, general manager. Is a producer of silver and copper. Main tunnel, 1,000′. Has steam and gasoline power and a concentrator, employing 250 men, at last accounts.

COMPAÑIA MINERA IGNACIO RODRIGUEZ RAMOS, S. A. **MEXICO.**

Office: Jiménez, Chih., Mex. Mine office: Baca, Chihuahua, Mexico. Alfredo Rodriguez, president; Rafael L. Luiroz, general manager; Ramón G. Aguirre, superintendent. Organized 1902, under laws of Mexico. Lands, 15 pertenencias. Country rock is limestone, carrying ore bodies occurring as replacements in lime. One lense, under development, has a width of 78′ and length of 140′, with depth not ascertained, carrying malachite, azurite and galena, averaging 5% copper, 25% lead, 6% zinc, 15 oz. silver and $8 gold per ton, opened by an 800′ shaft and tunnels of 400′ and 900′. Mine has a steam hoist and two electric drills, and ships ore to the American Smelting & Refining Co., for reduction. Production, 1905, was circa 35,000 metric tons of ore, and production therefrom is estimated at 2,750,000 pounds fine copper.

RAMSDELL-PARROT MINE. **MONTANA.**

Letter returned unclaimed from former mine office, Butte, Silver Bow Co., Mont. Is connected on the 400′ and 500′ levels with the Colusa-Parrot mine.

RANKIN COPPER MINING CO. **WYOMING.**

Office and mine: Rawlins, Carbon Co., Wyo. Organized 1904, with capitalization $25,000. Presumably idle.

RANSON COPPER MINING COMPANY OF ONTARIO, LTD. **ONTARIO.**

Office: Sault Ste Marie, Mich. B. Frank, president; David Rustander, secretary; D. J. Ranson, superintendent; R. H. Taylor, consulting engineer. Organized 1902, under laws of Ontario, with capitalization $3,000,000, shares $1 par. Lands, 3,600 acres, in Chesley and Anderson townships, Algoma, Ontario, said to show 14 veins, of which 6 contact veins have been opened by 8 shafts, of 23′ to 75′ depth, veins averaging 25′ width and giving assay values of 12% copper and 3 oz. silver per ton, from chalcopyrite. Has steam power. Idle for several years.

RARITAN COPPER WORKS. **NEW JERSEY.**

Owned by United Metals Selling Co.

RARUS MINE. **MONTANA.**

Owned by Butte Coalition Mining Co.

RAVEN MINE. **WYOMING.**

Letter returned unclaimed from former mine office, Encampment, Wyo.

RAVEN MINING CO. **MONTANA.**

Office and mine: Butte, Silver Bow Co., Mont. W. L. Thornton, president; John Berkin, vice-president and general manager; Chas. Mattison, secretary and treasurer. Organized 1903, with capitalization $500,000, shares $1 par. Bonds, $65,000 issued. Amount of cash in treasury probably is small.

Lands include the Raven mine, owned outright, and a 6–7 interest in the Snoozer mine, balance of 1–7 of latter being owned by the Red Metal Mining Co., which is the operating company of the Butte Coalition Mining Co. Area of Raven and Snoozer claims is 23 acres. Lands have an east and west length of circa 2,000′, in line with the Mountain Consolidated mine of the Boston & Montana. The Raven shows 3 plainly defined veins, and has a 625′ shaft, on which no mining has been done recently. To a depth of circa 500′ the Raven was a silver-gold mine, producing ores carrying an average of 16 oz. silver per ton, with good gold values, and is said to have produced circa $150,000. At depth copper is increasing, showing ores of 1% to 2.5% tenor at the bottom of the shaft.

The Snoozer mine has shafts of 75′ and 125′, both idle, production being secured through the Buffalo shaft of the Anaconda company. The Snoozer shows 4 veins and ore produced therefrom is said to average 4% copper, 8 oz. silver and $1.25 gold per ton. The Snoozer has been opened on the 800′ and 1,200′ levels by crosscuts from the Buffalo shaft of the Anaconda, and a crosscut is opening the 1,500′ level. The 1,200′ level shows a 4′ vein carrying ore averaging 11.6% copper, 9 oz. silver and $8 gold per ton. Work was suspended January, 1906, owing to the use of the Buffalo shaft being taken away, temporarily, but in February, 1906, the Raven was shipping 35 to 40 tons of ore daily, to the Washoe smelter of the Anaconda.

The Raven lands are well located, though small in area, but there has been entirely too much stock-market manipulation, during the past year, the responsibility for which has not been fully placed.

RAWLEY MINING CO. **COLORADO.**

Mine office: Bonanza, Saguache Co., Colo. David O. Weems, manager. Ores carry lead, silver and copper. Has steam and electric power.

RAY COPPER MINES, LTD. **AUSTRALIA.**

Offices: 1, Gresham Bldgs., London, E. C., Eng. Mine office: Ray, Pinal Co., Ariz. Employs 9 men. A. C. Gordon, manager; W. H. Westerfelt, metallurgical superintendent. Property has been in the hands of a receiver, since 1901, owing to bad management and litigation. Lands 1,296 acres, on Mineral Creek. Mine is opened by shafts and tunnels, and equipment included steam and gasoline power and a 6-mile narrow-gauge railroad, connecting the mines and works. The reduction plant included a 250-ton concentrator and a smelter, erected circa 1897, but never blown in, which was burned March, 1906.

The mine is under lease to the Kelvin Reduction Co., and has been estimated to show nearly 1,000,000 tons of ore averaging 4.5% copper. Sundry tests, in 1905, are said to have produced concentrates averaging 31.5% copper, with small gold and silver values. An experimental leaching plant is in operation.

RAYNOR COPPER MINING CO. **CALIFORNIA.**

Office: 1003 Call Bldg., San Francisco, Cal. Mine office: Lewis, Mariposa Co., Cal. John N. Bourdette, president; H. V. Raynor, secretary;

John C. Jens, manager. Has carbonate and sulphide copper ores, opened by shafts, with gasoline power. Presumably idle.

READY BULLION COPPER CO.

Office: 517–131 State St., Boston, Mass.

READY PAY MINING CO. **NEW MEXICO.**

Mine office: Hillsboro, Sierra Co., N. M. Ores carry gold, silver and copper. Idle.

COMPAÑIA MINERA REAL DEL MONTE y PACHUCA. **MEXICO.**

Mine office: Pachuca, Chihuahua, Mex. Pablo Martinez del Rio, president; A. F. Holden, managing director; preceding officers, W. H. Coolidge, E. A. Clark and Señor Eiguero directors; M. B. Spaulding, manager; T. H. France, consulting engineer. Control passed, February, 1906, to United States Smelting, Refining & Mining Co., through the purchase of a majority of stock.

NEGOCIACION MINERA REAL DEL MONTE, UNION y BILBOA. **MEXICO.**

Mine office: Ojocaliente, Zacatecas, Mex. H. Dalonne, manager. Has cupriferous silver-lead ores. Employed about 125 men, at last accounts, and planned installing a steam plant and small mill.

REALITO MINING CO. **MEXICO.**

Letter returned unclaimed from former office, Guadalajara, Mex. Mine office: Tapalpa, Jalisco, Mexico. Silviano Camberos, manager. Lands, 25 pertenencias, near Chiquilistlán, 50 kilometers northwest of Sayula, including the Cuprifera, Rinconada and Sin Nombre groups. Ore occurs in "mantos" and fissures, giving assays up to 60% copper, 2 kgs. silver and $10 gold per ton. A little ore, smelted in adobe furnaces, at the mines, has given good returns.

REALITY SYNDICATE. **CALIFORNIA.**

Succeeded by California Improvement Co.

REBECCA COPPER MINING CO.

Office: 542 The Rookery, Spokane, Wash. Moribund.

REBECCA EXTENSION COPPER MINING CO.

Office: Spokane, Wash. Moribund.

MINA LA RECOMPENSA. **MEXICO.**

Mine office: Santa Maria Dolores, Durango, Mex. P. J. Opperman, superintendent. Ores carry gold, copper and zinc. Has steam and water power and a 10-stamp mill, employing circa 50 men, at last accounts.

RED BIRD MINING CO. **MONTANA.**

Office: Helena, Mont. Mine office: Austin, Lewis & Clark Co., Mont. Employs 24 men. J. M. Clements, president and treasurer; Frank Jacquemin, vice-president; A. A. Pelletier, secretary and general manager; preceding officers, Robert Lucas and C. O. Clark, directors; J. C. McNamara, superintendent. Organized August 18, 1902, under laws of Montana, with capitalization $1,500,000, shares $5 par; issued, $1,437,500. Has paid dividends of $72,000, to end of 1905.

Lands, 7 claims, area 140 acres, including the Red Bird mine, in the

Greenhorn district, showing granite and limestone country rocks, carrying 15 fissure veins, of which 2, of 5′ average width are developed by the 400′ Red Bird shaft and the 300′ Copper Hill shaft. The Copper Hill mine shows sulphide ore averaging 1.3% copper, with a 30% excess of iron, in a 60′ vein, and is to be explored by diamond drill. The Red Bird mine is extensively developed, having about one mile of workings, estimated to put 250,000 tons of ore in sight. Estimated average ore values of the Red Bird, as given by a former management, were 21% copper, 45% lead, 35 oz. silver and $5 gold per ton, but these figures probably were excessive.

Equipment includes a 180-h. p. steam plant, with 4 hoists, good for 500′ depth, and a 4-drill air-compressor, also 5 mine buildings, for various uses. Ore is shipped to the Helena smelter, over the Southern Pacific railroad, which reaches the mine by a one-mile spur. Management is good and property is considered valuable.

RED CLOUD MINE. **MONTANA.**

Office and mine: Garnet, Granite Co., Mont. Dr. Peter Mussigbrod, manager. Ores carry gold, silver, copper and lead. Has a 10-stamp mill and steam power, employing circa 35 men.

RED CLOUD MINING CO. **CALIFORNIA.**

Office: Los Angeles, Cal. Mine office: Salton, Riverside Co., Cal. E. H. Gould, superintendent. Ores carry gold, silver, copper and lead. Has steam and gasoline power, 2-stamp mill, concentrator and 80-ton smelter. Presumably idle.

REDDING GOLD & COPPER MINING CO. **CALIFORNIA.**

Office: 222 California Safe Deposit Bldg., San Francisco, Cal. Mine office: Redding, Shasta Co., Cal. Employs 12 men. H. D. Irwin, president; T. M. Gilbert, vice-president and general manager; Thos. Gilbert, secretary; J. H. Creighton, superintendent; preceding officers, F. E. Mayhew, A. Ahnefeld and P. N. Ramussen, directors. Organized under laws of South Dakota, with capitalization $1,000,000. Has authorized a bond issue, amount not learned, at 6%. Lands, circa 30 claims, including the Bedford group, north of the Sky Blue group, at the mouth of Middle Creek, and sundry claims at Clear Creek, in the Muletown district, circa 7 miles west of Redding, also placer gold claims. In September, 1905, was damming Clear Creek one mile above the Redding and Eagle bridge, to develop a 70′ head, for a hydro-electric power plant, and was said to plan building a 500-ton custom smelter, on which work was to have begun in spring of 1906.

REDEMPTION MINE. **ARIZONA.**

Office and mine: care of R. J. Ferguson & Sons, owners, Chloride, Mohave Co., Ariz. Ores are auriferous and argentiferous copper oxides. Idle.

RED FOX MINING CO. **BRITISH COLUMBIA.**

Mine office: McGuigan, Yale district, B. C. Has argentiferous lead and copper ores, slightly developed. Presumably idle.

RED HILL MINING & SMELTING CO. **CALIFORNIA.**

Office: care of C. B. Allen, secretary, Los Angeles, Cal. Dr. C. J. Allen,

president; J. W. Jackson, vice-president. Lands, sundry claims, circa 10 miles from Victor, San Bernardino county, California. Idle and apparently moribund.

RED JACKET & BISBEE DEVELOPMENT CO. **ARIZONA.**

Out of business. Fully described in Vol. IV.

RED METAL MINING CO. **MONTANA.**

Mine office: Butte, Silver Bow Co., Mont. Thos. F. Cole, president; W. D. Thornton, vice-president; preceding officers, J. C. Lalor, C. D. Fraser and James O'Grady, directors; Arthur C. Carson, general manager; Geo. Moulthrop, general superintendent. Organized February, 1906, under laws of New York, with capitalization $1,000,000. Entire stock issue is held by the Butte Coalition Mining Co., and the Red Metal Mining Co. is a holding company for the Butte Coalition, direct title to lands being vested in the Red Metal Mining Co. Holdings are supposed to include the lands described under the title of Butte Coalition Mining Co., also the Alice mine and a few other small properties, including a seventh interest in the Snoozer mine of the Raven Mining Co.

RED MOUNTAIN GOLD & COPPER REDUCTION CO. **WASHINGTON.**

Letter returned unclaimed from former office, care of Scandinavian-American Bank, Seattle, Wash. Lands are in Chelan county, Washington.

RED ROCK COPPER CO. **ARIZONA.**

Mine office: Tuscon, Pima, Co., Ariz. J. C. Perry, agent. Idle.

RED STAR MINE. **BRITISH COLUMBIA.**

Mine office: Princeton, Yale district, B. C. Lands, one claim, opened by tunnel, showing a vein of 6″ to 6′ width, carrying melaconite and chalcopyrite, assaying up to 27% copper and $4 gold and silver per ton.

RED STAR MINING CO. **WASHINGTON.**

Mine office: Kalama, Cowlitz Co., Wash. Ores carry gold, cinnabar and copper. Idle.

RED WING MINE. **ALASKA.**

Mine office: Ketchikan, Alaska. Capt. E. E. Wyman, owner. Plans installing an air-compressor and power drills, and beginning smelter shipments, during 1906.

RED WING EXTENSION MINING CO. **UTAH.**

Title changed, circa March, 1906, to Massasoit Mining Co.

RED WING MINING & MILLING CO. **UTAH.**

Succeeded, circa 1900, by New Red Wing Mining Co.

REDWOOD COPPER QUEEN MINING CO. **CALIFORNIA.**

Office: San Francisco, Cal. W. P. Ferguson, president; Thos. Mellersh, secretary and treasurer. Lands, 840 acres, patented, 35 miles southeast of Ukiah, Mendocino county, California, developed by tunnels and winzes. Vein, much broken by faults prominent on surface, has a 2′ to 4′ gossan capping, traceable for a mile. Country rocks are brecciated porphyry and sandstone. Ores include cuprite, melaconite, malachite, azurite, chalcopyrite and tetrahedrite. Idle.

REED GOLD & COPPER MINING CO. **VIRGINIA.**

Letter returned unclaimed from former office, Norfolk, Va.

REED'S CREEK MINE. **AUSTRALIA.**

Owned by Queensland Copper Co., Ltd.

REFORMA MINING CO. **MEXICO.**

Letter returned unclaimed from former mine office, Fuerte, Sinaloa, Mexico.

REFUGIO GROUP. **MEXICO.**

Letter returned unclaimed from former mine office, La Cananea, Sonora, Mexico. Lands, circa 900 acres, said to have been sold, 1905, to Archibald & Marshall, of London.

CAMPAÑIA MINERA LA REINA. **MEXICO.**

Mine office: Cusihuiriáchic, Chihuahua, Mex. Ramón Navarro, president and manager. Property is a mine producing gold, silver, lead and copper, latter in very small quantities, as a by-product. Has gasoline power and three Huntington mills, employing about 150 men.

MINA REINA DE COBRE. **MEXICO.**

Mine office: Alamos, Sonora, Mexico. Alfredo R. Cano y Ca., owners; Juan G. Cano, manager. Has cupriferous and argentiferous copper ores.

COMPAÑIA MINERA REINA DE COBRE. **MEXICO.**

Mine office: Ejutla, Oaxaca, Mex. Capitalization $100,000, Mexican. Jas. Butler, general manager; Juan de Peza, superintendent, at last accounts. Property is the Luna de Oaxaca mine.

MINA REINA DE COBRE. **MEXICO.**

Owned by La Union Consolidated Copper Co.

REINDEER COPPER & GOLD MINING CO. **IDAHO.**

Office and mine: Mullan, Shosone Co., Idaho. A. M. Strode, manager. Lands, 5 claims, said to have a vein carrying a 2′ paystreak of 16% to 21% copper and 3′ to 6′ of copper ore of concentrating grade. Has a steam plant and air-compressor.

REINDEER MINING CO. **IDAHO.**

Succeeded by Reindeer Copper & Gold Mining Co.

REINS COPPER CO. **MONTANA.**

Office and mine: 46 East Broadway, Butte, Silver Bow Co., Mont. J. M. Guffey, president; J. P. Reins, and Asa Childs, vice-presidents; preceding officers, Wm. P. De Armit, Hon. John Miller, Frank J. Weixel, E. W. Marland, Geo. W. Stapleton, W. W. McDowell, E. D. Leavitt and Guy Stapleton directors; W. F. Johnson, secretary and treasurer; G. B. Thompson, assistant secretary and treasurer; Thomas Bryant, consulting engineer; John Stewart, superintendent. Organized April 27, 1903, under laws of Montana, with capitalization $1,500,000, shares $1.50 par.

Lands, 1 claim, formerly known as the Betsy Dahl, and later as the Combination, area 18 acres, in the Meaderville district, just east of Butte. Mine was idle 1881-1902, on account of litigation. Property is small, but valuable, being well located, adjoining the Leonard, Colusa and Minnie Healy mines, all good producers, and is supposed to carry the extension of the Leonard vein.

The Combination shaft was 1,200′ deep, May, 1906, and crosscuts were being driven north and south, at that depth. It is planned to sink this shaft to 2,000′ depth, but the ground is broken and wet, making sinking slow and expensive. The shaft has 2 compartments, but is to be cut down to 3-compartment size. The mine has shown some good argentiferous copper and lead ores, including chalcopyrite, assaying up to 60% copper and 200 oz. silver per ton.

Equipment includes a 240-h. p. steam plant, with a hoist good for 2,000′ depth, and two 700-gallon pumps, one on the 800′ level and one on the 1,200′ level, also a 5-drill air-compressor. Management seems good and the property, though small, is considered decidedly promising.

RELIANCE GOLD & COPPER MINING CO. **ARIZONA.**

Office: 15 Brown Palace Hotel, Denver, Colo. Mine office: Turkey, Yavapai Co., Ariz. C. S. McElrath, president; E. J. Price, vice-president; H. G. Trester, secretary; W. D. Webster, superintendent. Organized January, 1904, under laws of Arizona, with capitalization $1,500,000, shares $1 par. Was promoted by Herbert S. Shaw. Lands, 11 claims, area 220 acres, in 2 groups, in the Big Bug district, circa 10 miles from a railroad, opened mainly by tunnel, showing auriferous and argentiferous copper ore of uncertain tenor. Idle since circa 1904, apparently with poor prospects of resumption.

RELIANCE GOLD MINING CO. **ARIZONA.**

Office: care of W. C. Edgar, secretary and treasurer, Chicago, Ills. Mine office: Groom Creek, Yavapai Co., Ariz. Employs circa 75 men. C. E. Rollo, president; L. A. Davies, general manager and chairman executive board. Capitalization $1,200,000, shares $1 par; issued, $800,000.

Lands, 10 claims, area 200 acres, on Hassayampa creek, 8 miles from Prescott, property being well timbered with spruce, pine, and juniper. Mine has a 350′ two-compartment shaft, with circa 2,000′ of drifts, on 4 levels, all in ore, with about 20,000 tons blocked out for stoping. Ores are auriferous copper and lead sulphides, associated with iron pyrites, values ranging from $4 to $350 per ton. Equipment includes a steam plant, with hoist good for 500′ and a 6-drill air-compressor. Buildings include a boarding house, bunkhouse, assay office, stable, etc.

The mill, of 50 tons daily capacity, on the banks of Hassayampa creek, has a Gates crusher, 3 sets of rolls, trommels and Hartz jigs, and under the same roof is a mill with 5 gravity stamps, hydraulic sizers, three 6′ Frue vanners and 1 Standard concentrator, and a power plant with an 80-h. p. boiler and a 60-h. p. engine. Production is circa 350 tons of concentrates and 25 tons of smelting ore, per month.

RELIANCE MINING & MILLING CO. **PENNSYLVANIA.**

Office: Lancaster, Pa. Mine office: Hunterstown, Adams Co., Pa.

REPUBLIC CONSOLIDATED MINING & MILLING CO. **COLORADO.**

Mine office: Idaho Springs, Clear Creek Co., Colo. Thos. B. Crow, superintendent, at last accounts. Ores carry gold, silver, lead and copper. Has steam power.

REPUBLIC MINES CO. **NEW MEXICO.**

Office, 526 Exchange Bldg., Denver, Colo. Mine office: Lucero, Mora Co., N. M. Felix J. Woodward, president; W. Littlefield, vice-president; Marcus Finch, secretary-treasurer.

Organized under laws of Colorado, with capitalization $500,000, shares $1 par. Lands, circa 7,500 acres, patented, one-half owned in fee and one-half bond and lease, opened by 5 shafts of 20′ to 60′ depth, and tunnels of 120′, 140′ and 650′, showing 6% copper ore.

REPUBLIC MINING CO. **MEXICO.**

Office: 1036 National Life Bldg., Chicago, Ills. Geo. F. Grove, president; W. A. Arms, vice-president; Robert J. McNabb, secretary; E. L. Bigham, treasurer.

REPUBLIC SMELTING CO. **COLORADO.**

Office and works: Leadville, Lake Co., Colo. Capitalization $500,000. Property is the remodeled 500-ton smelter, with 3 furnaces, formerly owned by the Boston Gold-Copper Co.

RESCUE COPPER CO. **ARIZONA.**

Office: 8 South Sixth St., Ft. Smith, Ark. Mine office: Gila Bend, Pima Co., Ariz. Is closely connected in management with the Cornelia Copper Co., and, early in 1906, was said to be installing a reduction plant on a new system, which is fully described in the article on Cornelia.

RESOLUTE COPPER CO. **MICHIGAN.**

Wound up. Lands sold, 1905, to Keweenaw Copper Co.

MINA RESTAURADORA. **ARGENTINA.**

Owned by Capillitas Copper Co., Ltd.

MINA LA REVANCHA. **MEXICO.**

Mine office: Ojocaliente, Zacatecas, Mex. J. Incarnacion Spina, owner; R. Spina, manager. Ores carry silver, lead and copper. Has steam power and a Chilean mill, employing about 50 men, at last accounts.

REVENUE MINING CO. **ARKANSAS, UTAH & WASHINGTON.**

Office: 201 Northwestern Bldg., Minneapolis, Minn. Frank E. Plummer, president; Edwin Perry, vice-president; D. A. Simmons, secretary; Sterling Cross, treasurer. Organized 1901, under laws of Arizona, with capitalization $1,250,000, shares $1 par. Lands include the Revenue group, 140 acres, showing copper-gold ores, in Stevens county, Washington, also oil lands in Utah, zinc and slate lands in Arkansas, and a gas franchise for the town of Belton, Missouri. Idle.

REVENUE MINING & MILLING CO. **WYOMING.**

Office: care of F. D. Russel, Denver, Colo. Letter returned unclaimed from former mine office, Encampment, Carbon Co., Wyo. Development is by two tunnels, cutting two veins giving good assay values in copper, and also carrying small quantities of gold, nickel and uranium. Idle for several years.

REWARD COPPER MINING CO. **ARIZONA.**

Mine office: Vekol, Pinal Co., Ariz. Has auriferous copper ores, with steam plant, 20-stamp mill and 20-ton cyanide plant. Idle.

REWARD MINE. **CALFIORNIA.**

An old and idle mine in Plumas county, California, formerly known as the Cosmopolitan. Was a producer, circa 1863. Is opened by tunnels and shaft.

REX COBRE MINING CO. **ARIZONA.**

Office: Muskegon, Mich. Mine office: Safford, Graham Co., Ariz. Dr. B. D. King, president; J. B. Barlow, secretary and treasurer. Organized 1903, under laws of Arizona, with capitalization $1,000,000, shares $1 par. Lands, 20 claims, area 320 acres, in the Lone Star district, showing fissure veins, developed by a two-compartment incline shaft of 540′, with 700′ of underground openings. Has a 28-h. p. steam hoist. Idle at end of 1905, but planned resumption.

REX GOLD MINES & INVESTMENT CO. **COLORADO.**

Mine office: Leadville, Lake Co., Colo. Jesse F. McDonald, manager. Lands include the Rattler and Reconstruction mines, carrying gold, silver, lead and copper ores. Has steam power.

REY DEL ORO MINING CO. **MEXICO.**

Owns the Mulatos mines, in the Sahuaripa district of Sonora, Mexico. Stock issue is owned outright by the Greene Gold-Silver Co.

COMPAÑIA MINERA LOS REYES. **MEXICO.**

Mine office: Zitacuaro, Michoacán, Mex. Rafael Rodriguez Gil, manager. Has a tunnel, showing copper ore.

REYNOLDS-ALASKA DEVELOPMENT CO. **ALASKA.**

Office: 27 State St., Boston, Mass. Mine office: Valdez, Prince William Sound, Alaska. Employs 60 men. Henry D. Reynolds, president; Chas. H. Kingsbury, vice-president; Hon. John G. Brady, secretary and treasurer; Blamey Stevens, general manager; preceding officers and Hon. Eben Smith, directors; W. Bertram Hancock, mine superintendent. Organized 1903, under laws of Washington, with capitalization $3,000,000, shares $1 par, in $1,000,000 cumulative 6% preferred stock and $2,000,000 common shares; issued, $2,088,826. On February 1, 1906, had $105,648.48 cash on hand, without accrued liabilities. Washington Trust Co., Boston, transfer agent and registrar; Audit Company of New York, auditor. Annual meeting, approximately May 13, on call of president.

Lands, 51 claims, area 1,020 acres, also an 80-acre millsite and 6,000 acres of coal and oil lands, in several different groups, in 2 different localities, in the Valdez district. Country rocks are slate, greenstone and porphyry, showing various contact veins between slate and greenstone.

The Boulder Bay group, 23 claims, area 460 acres, on the Kenai peninsula, Prince William Sound, shows a contact vein between greenstone and slate, carrying chalcopyrite, assaying 11% copper and $3 gold per ton, opened by 2 tunnels. Equipment includes a 60-h. p. boiler and a 5-drill Rand air-compressor.

The Latouche-Iron Mountain group, 20 claims, includes the Duchess and Blue Fox properties, on the west coast of Latouche Island, circa 60 miles west of Boulder Bay. The Blue Fox mine shows a 4′ vein of 7% ore

which it is planned to develop by shaft, topography being unsuited to tunneling. The Duchess mine, developed by tunnel, shows ore of somewhat lower grade than that found in the Blue Fox. The property on Latouche Island has a good water power available, and it is planned to install a hydroelectric power plant, with a flume and steel pipe, leading from Big Falls creek to a Pelton wheel, direct-connected to two 40-kw. generators.

The company also has a property known as the Aurora, slightly developed, but idle at last accounts. Management was said to be installing a 100-ton concentrator at its mine, equipment including a Gates crusher, 2 sets of rolls, 2 Huntington mills, 8 Frue vanners, and amalgamating plates, but no reference to this mill is made in the last report of the company. Present equipment includes a 60-h. p. steam plant, at the Boulder Bay property, and a 100-h. p. steam plant, at the Latouche-Iron Mountain group. It is planned to build a 150′ shipping wharf, at Boulder Bay, and it is hoped to begin regular shipments from this property during the summer of 1906. Management seems good, and property is considered promising.

REYNOLDS MINE. **VERMONT.**

Mine office: South Strafford, Orange Co., Vt. Property adjoins the Elizabeth mine. Idle for several years.

RHODE ISLAND COPPER CO. **MICHIGAN.**

Office: 32 Broadway, New York. Mine office: Boston, Houghton Co., Mich. Employs about 25 men. Wm. R. Todd, president; preceding officer, Isaac H. Meserve, Henry A. Wyman, C. J. Devereaux, Daniel T. Brigham and Jas. S. Dunstan, directors; W. A. O. Paul, secretary and treasurer; M. M. Dennis, superintendent. Organized 1899, under laws of Michigan, with capitalization $2,500,000, shares $25 par.

Official returns to the state of Michigan, as of date Jan. 1, 1905, disclose the following figures:

Amount of cash paid in on capital stock	$600,000.00
Amount paid in by conveyance of property	300,000.00
Entire amount invested in real estate	300,000.00
Amount of personal estate	47,130.89
Amount of floating debt	2,901.57
Amount due company	12,500.00

Lands, 800 acres, north of the Franklin Junior.

No. 1 shaft, 275′ north of the Franklin Junior boundary, is 8x18′, with 3 compartments, 500′ deep, sunk on the Pewabic amygdaloid, which is 8′ to 10′ wide, with 2′ to 3′ near the hanging wall well mineralized, at points. This shaft, abandoned 1902, is filled with water to the first level, on which it connects with No. 2.

No. 2 shaft, 1,200′ next north, also is 8x18′ in size, and is circa 1,300′ deep, having a frame shafthouse and Nordberg hoist capable of raising 2-ton skips from 1,000′ depth. A crosscut, driven 180′ east, encountered the Allouez conglomerate in March, 1903, and drifting on that lode was continued until July, 1904, when stopped, owing to lack of favorable ground. No. 2 shaft has crosscuts both east and west. The east crosscut, on the eighth level, at

a depth of 1,000′, cut two apparently valueless amygdaloids, one being the Mesnard epidote. The East lode, about 5′ wide, carries a little copper, but nothing especially encouraging. The West lode, 96′ from the shaft and 7′ to 9′ wide, carries considerable copper in bunches. The four amygdaloids lying between the West lode and the Allouez conglomerate have been tested by drifting north and south, three proving barren. Principal work of 1904, and the first 8 months of 1905, was on the Pewabic and West lodes. Latter was opened by crosscuts on the 8th and 9th levels, showing occasional encouraging ground. A 1,400′ drift on the 8th level north showed occasional patches of payable ground of 25′ to 75′ length, on the Pewabic amygdaloid. The north drift on the 8th level was discontinued at 150′ and the north level on the 10th level was stopped at 300′, after showing some improvement.

A new shaft, known as No. 3, was started, 1,800′ north of No. 2, in May, 1905, but work was discontinued at slight depth, and attention turned to the Kearsarge lode. Diamond drilling to locate the Kearsarge bed was begun November, 1905. The first cores showed copper in encouraging quantities, from a bed of circa 19′ width. The Kearsarge must underlie practically the entire tract, and the future of the property rests, apparently, upon finding it to carry copper in workable quantities.

Surface improvements include a 30x60′ machine and blacksmith shop, a 30x50′ frame warehouse and supply office, and 15 dwellings. No. 2 engine house has a 12-drill Rand air-compressor, operating 2 power drills.

RHODESIA COPPER CO., LTD. **RHODESIA.**

Office: Salisbury House, London, E. C., Eng. Lord Gifford, chairman; Bechuanaland Exploration Co., Ltd., manager in South Africa; T. G. Davey and Percy Tarbutt & Co., consulting engineers; Tom Donald, secretary. Organized January 31, 1902, with capitalization £750,000, shares £1 par. Has floated the Rhodesia Broken Hill mine, a zinc and lead property, and paid a 10% dividend to shareholders, 1905, in the stock of that company.

Lands, 640 square miles, and the right to locate 8,000 mining claims and 33 farms, in northern Rhodesia, of which 5,665 mining claims and 24 farms have been located. Company has a close working alliance with the Northern Copper (B. S. A.) Co., Ltd., and apparently both companies have some sort of claim to the Bwana M'Kubwa and Hippo mines, which are described in the article on Northern Copper. The Kitakata mine, ½ mile northeast of the Broken Hill, shows stains and hand-specimens of oxides and carbonate copper ores.

RICHARD III DEVELOPMENT CO., LTD. **BRITISH COLUMBIA.**

Office: Duncans, B. C. Mine office; Mt. Sicker, Vancouver Island, B. C. Lands lie east of the Tyee and are opened by a 510′ two-compartment shaft, with 2,181′ of workings on 5 levels, giving ore on each level. Best ore is on the bottom level, a sample ton smelted giving returns of 3.29% copper, 25.85 oz. silver and 0.66 oz. gold per ton. Property considered promising, but idle since 1904, owing to lack of capital.

RICHFIELD MINING CO. **MEXICO.**

Office: Mears Bldg., Scanton, Pa. Mine office: Querobabi, Ures, Sonora,

Mexico. Employs 30 men. Dr. S. T. Haffner, president; Maj. Jas. A. Cooper, vice-president; Dalbys L. Fickes, secretary and treasurer; W. D. Fredericks, general manager; Epifanio Mungaray, mine superintendent. Organized May, 1901, under laws of Arizona, with capitalization $5,000,000, shares $2 par; issued, $3,200,000. Bonds, $100,000, at 6%. Cash on hand, March, 1906, was $30,000.

Lands, 382 pertenencias, area 955 acres, in 2 groups, circa 12 miles from Tuape, and 35 miles from the Sonora railway, also 26,512 acres of timber lands, in the Ures district. Country rocks are granite and limestone, carrying 7 contact veins, of 16′ to 40′ estimated average width, opened by shafts of 73′ and 75′, and by tunnels of 48′ and 60′, showing carbonate and oxide ores and chalcopyrite, assaying 3% copper and 20 oz. to 60 oz. silver per ton, with small gold values. Property shows more or less antigua workings.

Early in 1906 the company was installing a 120-h. p. steam plant, with two 20-h. p. hoists, good for 600′ each, and a 4-drill air-compressor. Several mine buildings have been constructed. Company has suffered from lack of cash in the past, but is said to have passed under the management of financially responsible people, and active development and the building of a 50-ton concentrator are contemplated.

RICHMOND-EUREKA MINING CO. **NEVADA.**

Mine office: Eureka, Eureka Co., Nev. Albert Fries, president; W. H. Coolidge, vice-president; A. J. Seligman, treasurer; A. F. Holden managing director; A. P. Mayberry, mine superintendent. Organized October, 1905, under laws of Maine, with capitalization $3,600,000, shares $10 par, succeeding the Eureka Consolidated Mining Co. and the Richmond Mining Co. Is controlled by the United States Smelting, Refining & Mining Co., and stock is pooled in a 5-year voting trust, with A. F. Holden, B. Naumberg and Albert Fries, trustees.

The Richmond and Eureka mines are contiguous properties, opened circa 1869, and are said to have produced $75,000,000 in ore values, above the water-level, but this probably is an overestimate. Properties were tied up by litigation, for some years, until recently, during which time considerable scramming was done, by tributors. The ores carry an excess of iron and should be valuable for fluxing the Utah ores of the United States company. Mines have railroad connections. The smelter, at Eureka, 3 miles from the mines, is antiquated in design and equipment, and has been idle for some years.

RICHMOND GROUP GOLD MINES CO. **NEW MEXICO.**

Office: Board of Trade Bldg., Boston, Mass. Letter returned unclaimed from former mine office, Hillsboro, Sierra Co., N. M. Ores carry gold and copper. Has steam power.

RICHMOND MINE. **MONTANA.**

Mine office: Saltese, Missoula Co., Mont. Chas. J. Heidenreich, manager. Lands, 6 claims, southwest of Saltese, adjoining the Monitor mine, opened by a 275′ shaft, showing considerable native copper and ores assaying up to $60 per ton, in copper and gold values. Property has been a producer, in a small way, for some years, and is said to have been worked at a profit.

RICHMOND MINING CO. **NEVADA.**

Merged, 1905, in Richmond-Eureka Mining Co.

RIGBY MINING & REDUCTION CO.

Office: care of F. H. Walker, secretary and treasurer, Beaver Falls, Pa. Works office: Mayer, Yavapai Co., Ariz. Col. T. Johns Rigby, president and general manager; preceding officer, R. D. Mead, L. S. Neely and Edward C. Fink, directors; Harry A. Clarke, superintendent. Lands, 70 acres, near Mayer, being a smelter-site, connected by a 3,000′ spur line with the Prescott & Eastern Railway.

This company holds the Yavapai county rights to the Poehle & Croasland volatilization process, and has a 125-ton reduction plant, blown in, April, 1906. The process of reduction is as follows: from the receiving bins, ore is taken in tram-cars to 2 revolving dryers, one of 40″ diameter by 18′ length and the other of 60″ diameter by 26′ length, heated ore passing from them, by gravity, to cars, which take it to the feed-hoppers in the roll-house, latter having 3 sets of 30x14″ rolls and 1 set of 20x12″ rolls, with screens and elevators. Dust from rolls is collected by 3 large dust-collectors. Crushed ore is taken from the screens to a 40-ton ore-bin in the mixing-house, by an 84′ automatic belt-conveyor. In the mixing-house, ore and salt from the salt-bins are weighed by 2 sets of hopper scales, and deposited on a 50′ belt-conveyor, which takes the material to a box-mixer, whence the mixed charge is dumped into a car which takes it to 4 feed-hoppers, which feed the charges automatically to revolving furnaces, in a furnace building 88x132′ and 40′ high, having four 25-ton revolving calcining furnaces. Fumes from the ore are drawn from the furnaces through the flue-house, which contains 4 sets of 3′ wrought-iron pipe, each 175′ long, into the condensing house, by 4 large blowers, each capable of handling 6,600 cubic feet of gas per minute. Fumes are cooled by water, in the flue-chamber, then forced under pressure into the condensing room, where deposited as chlorides, condensing-room fumes going to the filtration room, where all insoluble matter is filtered, and where metallic values are precipitated, either by electric action, or on iron. Precipitates are melted and refined in the ordinary manner. The residue of the roasted ore, from which the metallic values are supposed to have been volatilized, is carried to the tailings dump, in tram-cars. The theory of the process is that the application of heat to the mixture of ore, salt and sulphur, causes a chemical reaction, by which the sulphur and sodium chloride form sulphate of soda, the chlorine from the salt uniting with the metals to form chlorides, which pass off in the fumes, and are recovered in the manner previously explained.

RILLITO MINING CO. **ARIZONA.**

Letter returned unclaimed from former mine office, Tucson, Ariz.

RINCON MINING CO. **ARIZONA.**

Office: care of B. J. O'Reilly, secretary, Bisbee, Ariz. Organized under laws of Arizona, with capitalization $2,500,000, shares $25 par. Lands, 27 claims, 22 miles north of Benson, Cochise county, Arizona, developed by a 130′ tunnel, showing ore giving assays up to 23% copper.

RINGING ROCKS COPPER MINING CO. **PENNSYLVANIA.**

Mine office: Pottstown, Montgomery Co., Pa. Idle.

RIO ALTO COPPER CO. **COLORADO.**

Capitalized at $1,500,000, shares $1 par, equally divided into 8% preferred and common stock. H. M. Comstock, general manager. Lands, claimed to be 300 acres, in Northwestern township, Custer county, Colorado. Company claimed to have 3½ miles of underground workings, and to be building a 50-ton reduction plant, but neither statement verified, nor likely to be.

RIO ARRIBA CONSOLIDATED MINES CO. **NEW MEXICO.**

Letter returned unclaimed from former office, Milwaukee, Wis. Mine office: Tres Piedras, Taos Co., N. M.

RIO DOLORES COPPER CO. **UTAH.**

Office: 731 East 18th Ave., Denver, Colo. Mine office: Castleton, Grand Co., Utah. Employs 20 men. Fred G. Shaffer, president; Victor A. Elliott, vice-president; Thos. B. Crawford, secretary, treasurer and general manager; Will Eastman, superintendent; Walter Mitchell, engineer. Organized February 1, 1906, under laws of Arizona, with capitalization $2,000,000, shares $1 par; issued, $1,750,000. Statement, as of date March 19, 1906, gives cash on hand, $37,500. Annual meeting, first Thursday in July.

Lands, 15 claims, area 300 acres, also 100 acres in millsites, in the La Sal district, showing granite country rock, with porphyry intrusions, carrying 12 ore bodies, of which 2, slightly developed by 100′ of tunnels, are of 30′ estimated average width, showing ores estimated to carry average values of 2% to 3% copper, 10 oz. silver and $3 gold per ton. Equipment is to include a 5-drill air-compressor and 6 log buildings. The company plans driving a 500′ tunnel.

SOCIÉTÉ MINES DE CUIVRE ET DE PLOMB DE RIO FARDIS. **SPAIN.**

Mine office: Molinillo, Ciudad Real, Spain. Organized August, 1903, under laws of France, with capitalization 2,500,000 francs, shares 250 f. par, to develope argentiferous lead and copper properties, near Molinillo.

COMPAÑIA MINERA RIO GRANDE y DOLORES DE LONDRES. **MEXICO.**

Offices: 37, Old Jewry, London, E. C., Eng. Mine office: Guadaiupe, Guerrero, Mex. A. R. MacSwinney, manager. Operates La Nave mine, producing silver and copper. Has steam and water power, concentrator and leaching plant, employing about 40 men, at last accounts.

RIO GRIO DISTRICT COPPER CO. (TOBED & CODOS EXPLORATION), LTD. **SPAIN.**

Offices: 12, Lime St., London, Eng. J. Paul, Vicomte de Lassus, chairman; A. Fougere, consulting engineer; A. L. Lanseigne, secretary. Organized Oct. 30, 1903, with capitalization £130,000, shares £1 par; issued, £97,987. Lands include 14 properties in the province of Zaragoza, Spain. Presumably idle.

RIO HONDO COPPER CO. **NEW MEXICO.**

Dead. Property sold, circa 1900, to San Cristobal Copper Co.

RIO LUNA MINES CO., LTD. **SPAIN.**

Offices: care of J. N. Derbyshire, secretary, Nottingham, Eng. Mine office: Campo La Lomba, León, Spain. Edward H. Pares, president. Capitalization, £120,000. Lands, 135 hectareas, including the Riello mine, carrying auriferious and argentiferous copper sulphides. Idle for some time.

RIO NEGRO MINES LTD. **SPAIN.**

Offices: 6, Suffolk St., Pall Mall, London, S. W., Eng. Mine office: Campo La Lomba, León, Spain. Alfred DuCros, chairman; W. T. Cunningham, secretary. Organized Aug. 2, 1899, with capitalization £250,000, shares £1; issued, £235,007. Debentures, £15,000 authorized; £14,000 issued. Lands, 8 claims. Presumably idle.

RIO RIMAL COPPER CO., LTD. **SPAIN.**

Offices: 17, Fenchurch St., London, E. C., Eng. Mine office: Figueras, Gerona, Spain. Organized, July 18, 1900, as Afortunada Copper Mines, Ltd., name changed, 1903, to present title, with capitalization £75,000, shares £1 par. Lands, area circa 12 hectareas, known as the Afortunada mines, held on perpetual lease from the Spanish Crown, at a rental of 236 pesetas yearly, plus 2% royalty on production. Receiver and manager appointed, August, 1905.

RIO TENIDO COPPER MINES, LTD. **SPAIN.**

Voluntarily liquidated, April, 1903.

MINAS DE COBRE DE RIO TINTO. **MEXICO.**

Mine office: Terrazas, Chihuahua, Mexico. Employs 350 men. David Goodale, general manager; W. W. Marion, superintendent; H. Schenider, smelter superintendent. Property is owned by Juan A. Creel, of Chihuahua, and is under lease to Messrs. Frank Fletcher, David Goodale, W. W. Marion and Juan A. Creel. Lands, 50 pertenencias, near Terrazas, 25 miles north of the city of Chihuahua, on the Mexican Central Railroad. Mine was opened 1840, and has worked at different times since, with varying fortunes, producing considerable copper, but was practically closed down since circa 1901, until taken over by present operators, September, 1905. Country rock is limestone, showing several veins, occuring as fissures in limestone, or as lenses between the bedding planes of limestone, near a large intrusive dike of quartzite. Ore bodies are erratic in size and occurrence, but are connected and practically continuous, as a rule. The lime has an average dip of 45° to the northwest, showing 5 or 6 ore bodies, of 5′ to 50′ width, and 5′ to 150′ length, with unknown depth. The ore bodies are low in grade, but the deposits are extensive. Property shows a little sulphide ore, but mainly oxidized ores of estimated average value of 4% copper, 5 oz. silver and 20 cents gold per ton.

Development is by about 1 mile of tunnels, and by numerous pits of 50′ or less in depth, with 6 shafts as follows: Promontorio, 350′; Verde, 400′; Perdernal, 120′; Bronce, 150′ and Vinagre, 100′. The mine has a total of about 2 miles of underground workings. A reported strike of 3% nickel ore was a false alarm, as no such ore was found. Equipment includes 6-h. p. and 16-h. p. hoists, good for 400′ depth, a concentrator, sundry adobe mine buildings and 120 dwellings for workmen.

The smelter, ½ mile from the mine, receiving ore by carts, has a 150-ton water-jacket blast-furnace, turning out matte averaging 50% copper, 40 oz. silver and 0.3 oz. gold per ton, sent for refining to the Aguascalientes plant of the American Smelting & Refining Co. The smelter also does a general custom business, and is reached by a switch from the Mexican Central railway, the main line of which is only 1 kilometer distant. Water is secured by a 4" pipe-line of circa 1 mile length, with a pump station. Mine fuel is wood, costing $7 per cord, and coal, costing $13 per ton, and the smelter burns coke, costing $19 per ton. Management plans sinking until sulphide ore and water are found, and also plans installing new and larger hoists, adding new boilers, erecting sundry mine buildings and enlarging the smelter.

Production was begun January 31, 1906, and for February the product was 60 tons fine copper, estimated by management, to be made at a cost of 5 cents per pound, gold. In March, 1906, the smelter was treating circa 160 tons of ore daily. The Rio Tinto Mexicana is a mine of undoubted value. The ore, while low in grade, exists in large quantities, and the property is favorably located for operation. The present management is experienced, and should make a considerable producer of the mine.

RIO TINTO CO., LTD. **SPAIN.**

Offices: 30, St. Swithin's Lane, London, E. C., Eng. Mine office: Las Minas de Rio Tinto, Huelva, Spain. Employs circa 11,000 men. Chas. Wm. Fielding, chairman; preceding officer, Maj.-Gen. Sir Arthur E. A. Ellis, G. C. V. O., C. S. I., Lionel C. G. Sartoris, John M. Macdonald and John MacFarlan, directors; J. Gordon Macleod and Samuel J. Bowes, joint secretaries; Duff, Bruce & Co., British consulting engineers; D. Gonzalo Tarin, Spanish consulting engineer; Turquand, Youngs & Co., auditors; Commercial Bank of Scotland, Ltd., bankers; Freshfields, solicitors; W. A. Carlyle, general manager; R. E. Palmer, assistant manager; W. G. Nash, estate manager; G. W. Porteous, traffic manager; George Davey, superintendent; Gordon Douglass, engineer.

Organized March 29. 1873, with capitalization £3,250,000, increased November, 1905, to £3,500,000, shares £5 par, in £1,625,000, cumulative 5% preference shares and £1,875,000 ordinary shares. The new issue of 50.000 ordinary shares, £5 par, was sold to shareholders at £63 per share, netting the company £3,150,000, for the redemption of an outstanding bond issue of £3,065,300, in 4% debentures. Transfer form, common; fee, 2s. 6d; warrants to bearer issued in denominations of 1 share, fee 6d., and 5, 10, and 25 shares, fee 1s.; fee for conversion into registered shares, 2s. 6., per certificate. Stock Exchange settlement, all shares quoted in the official list. Fiscal year ends with the calendar year, and accounts are submitted in April, and an interim semi-yearly report is issued in October.

Dividends are payable in Paris by the Société Générale, 54, Rue de Provence, and in Bremen, Germany, by the Deutsche Bank. Dividends were begun 1879, and have been paid each succeeding year, varying greatly, according to net earnings. Dividends on the old ordinary £10 shares, from 1879 to 1896, inclusive, ranged from 6 shillings in 1886 to 38 shillings in 1896.

Volters, and after his death did fairly well under the direction of a French metallurgist named Tiquet. In the Eighteenth Century the mine was leased by the crown to a company of English adventurers, of whom the leading spirit was Lady Maria Theresa Herbert. During the chaotic period of the French invasion, early in the Nineteenth Century, the mine was abandoned, and after being reopened, in 1812, by the Spanish Crown, was worked in a small way only. For the next sixty years the mine was under the management of various lessees, until sold outright, in 1873, to Matheson & Co., of London, for 92,800,000 pesetas, that firm organizing the present company, which has proven one of the most profitable mining corporations in existence.

The remains of mining and smelting operations of the ancients are very notable. Don Gonzalo Tarin, Spanish consulting engineer to the Rio Tinto Co., Ltd., who has been closely connected with the mine since 1867, a period of forty years, in his very able work, "Memorias," estimates the quantity of scoria remaining from ancient smelting operations, whether Roman or Phœnician, or both, at no less than thirty million metric tons, and his acquaintance with the property and its history, and his opportunities of estimating and verifying these figures, are perhaps the best of any individual living. Lying above the slag-piles left by the Phœnicians is a 10′ bed of alluvium, on top of which lies the Carthago-Roman slags. The smelting practice of the Romans apparently was very good, the slags left by them being as clean as those produced to-day. It is possible, however, that some of the copper left in the old slags has been leached out, during some 2,000 years of partial exposure to the elements, but it is the opinion of Señor Tarin that the slags have been resmelted, in which case the very latest modern metallurgical practice is but a repetition of the work of two thousand years ago.

The only remains of ancient mining tools and machinery that have been found at the Rio Tinto are three water-wheels, of oak, and some bronze rims of kibbles, which presumably were of wickerwork. There also are many potsherds, including fragments of miners' lamps of the well-known classic pattern, and occasional Roman coins are unearthed.

The Roman system of mining, so far as can be judged from the evidence offered by the Rio Tinto mine, apparently was to cut narrow seams and slabs from the ore in large masses, either by wedging, or by the agency of quicklime, tamped into the crevices and then wetted, and possibly both methods were used, these being the plans most generally used previous to the adoption of gunpowder for blasting. The richer veins were followed persistently, and the ancients were good judges of values, as has been learned by many a modern mining company that has reopened old mines in Spain and Italy, in the hope of finding that much high-grade ore was left unmined—in which cases disappointment is almost certain to be met with. The Rio Tinto was not worked out, because the deposit was too vast, but the rich ores of the secondary zone of enrichment were quite effectually gouged out, in all the old workings. Indications favor the hypothesis that the ancient miners at the Rio Tinto used hard-faced tools and hand-drills, working directly on the faces and in the ore bodies.

The Rio Tinto is situated in a rugged district, in a spur of the Sierra Andevallo, though the hills sometimes are held to be a spur of the Sierra Aracena, which is itself a branch of the famous Sierra Morena. The Rio Tinto, however, is separated from the Sierra Andevallo, which is some 12 miles distant, by the rivers Odiel and Iárrama. Mines are 51 miles by rail inland, from the seaport of Huelva, in the province of that name, lying in the extreme southwestern corner of Spain, near the Portugese boundary.

The ore bodies of the Rio Tinto occur in mammoth masses, with clay-slate on the south and porphyry to the north, and are surmounted by immense gossan cappings, much decomposed, and easily broken for removal. The surface ore has been leached to the point of absolute worthlessness, the zone of secondary enrichment beginning at a depth of approximately 100′, and continuing to an average depth of circa 300′. The ores in this zone are of a materially better grade than those found below. The mine has three veins, or mineral zones carrying successions of lenses, these being known as the South, or Nerva lode, the Middle or San Dionisio lode, and the North lode, in addition to which there are two smaller detached lenses, adjacent to the North lode, which, like it, are being worked open-cast. There are five different mines, of which three are worked open-cast and two underground. The latter are worked pillar-and-stall, with levels every 12½ metres, levels being opened 4 metres high, and the entire floor divided into galleries and crosscuts of 4x4 metres, leaving pillars of 6x6 metres, which seems a rather ineffective method. The deepest shaft, nearly 1,200′, is in the San Dionisio mine, on the Middle vein, this being the westernmost shaft also. The principal workings are open-cast, and in these the capping is sliced down in terraces, and the ore mined in terraces also, cars being brought in by locomotives to as great a depth as practicable, both in stripping and quarrying. The possibility of using the caving system for underground mining has been considered. The principal disadvantage of underground mining is the scarcity and high price of wood, which could be obviated by the adoption of the caving system. Diamond drill borings show untouched ore bodies of upwards of 130,000,000 gross tons, giving sufficient reserves for nearly 70 years' production, at the present rate of mining, and it is not likely that the full extent of the ore bodies available has been proven. Upwards of 1,000,000 cubic metres of overburden are stripped per year, normally, and in 1905 stripping amounted to 1,809,969 cubic metres.

The ores carry an average of 1.5 oz. silver per ton, with traces of gold, and considerable silver is saved by the Claudet process, at the smelter. The ores are rich in sulphur and are assorted into three classes, of which the smelting ore carries 4% to 6% copper, the export ore about 3.5% copper and 45% to 50% sulphur, and the leaching ore 1.75% to 2% copper only. The average percentage of copper carried by the ores treated has ranged from 1.5% in 1876, the first year of production, to 3.234% in 1884, the average of copper extraction being 2.39% in 1903 and 2.34% in 1905, the tendency being downward. About half of the ore produced is smelted, the balance being leached, or sent abroad to burners, and about one-third of the total product is

exported for the sulphur content. The ores average 4% to 5% copper, in the zone of secondary enrichment, and gradually decline in value, with depth. until, at about 1,000′, the average is only about 1.25%. The main ore body is chalcopyrite, sparingly disseminated in massive iron pyrites, rich in sulphur. Reserve heaps at the mine were estimated, at close of 1903, to contain 147,685 long tons of fine copper. The copper output of the mine has shown little change since 1898. Owing to the richness in sulphur, the shipping ores of the Rio Tinto are in good demand, and in addition to supplying various British works, are exported to Germany, France, Belgium and sundry seaboard acid works of the United States. The bulk of the medium-grade ore is shipped to the company's works in Wales, where it is burned for sulphur, and the cinder treated by the Henderson wet process, for the extraction of copper. Production of the mine is divided into approximately 60% of blister copper, from smelting ores, and 40% of copper secured from the residue of ores shipped to various sulphur-burners.

Owing to the system of mining and reduction followed by the Rio Tinto, the mechanical equipment of the mine is not especially extensive, and there are none of the immense hoists and powerful machinery found at the other great copper mines of the world. This is due, not to lack of enterprise, but to the fortunate fact that much of the production is won open-cast, while the underground workings are neither deep nor extensive. Two new hoists were added, in 1905. The methods of lixiviation followed by the Rio Tinto are given at length in the chapter on metallurgy. In addition to the amount of copper estimated to be carried in the teleras, or primary leach-heaps, there are upwards of 100,000 long tons of copper in the tereros, or secondary leach-heaps. Owing to the alteration of heavy rainfalls with protracted seasons of drought, water storage is necessary, large dams having been constructed for that purpose. The ore leached at the mines is no longer calcined, the copper becoming soluble by natural weathering, assisted by systematic sprinkling, and scrap-iron, formerly used for precipitation, has been superseded by pig-iron from Bilbao. About 7,000,000 gallons of leach-water, strongly charged with copper in solution, are treated daily in the lixiviation plant.

The smelting plant at the mine, blown in 1902, has two 42x160″ elliptical water-jacket cupolas, 23′ 4″ over all in height, with charging doors 10′ above the bottoms, which are detachable and mounted on wheels. Each furnace has 8 water-jackets and 2 charging doors, ore and fuel being charged alternately. The furnaces discharge continuously into 30-ton settlers, 12′ in diameter and 40″ high, which have continuous slag discharge. The matte, running 29% to 34% in tenor, is taken in 8-ton ladles, by electric traveling cranes, to the converters, there being 6 stands, rotated hydraulically from an elevated platform, with 80x120″ shells, of horizontal barrel type, with spherical valves and 12 tuyeres each.

The shells are in two parts, for convenience in lining, and are double-lined with a 4″ external course of fire-brick, rarely replaced, and an inner section, 22″ to 26″ thick, of ground silica and low-grade quartzose copper ores, with 10% of clay for a binder. When newly lined the shells have a capacity

of only 3 to 4 tons each, increasing to about 8 tons when the inner linings are nearly burned out. The smelter product is shipped as converter bars, being blister copper of 98% to 99% fineness, and the product of the lixiviation works is "cascara," or cement copper.

The mines are connected with the sea-port of Huelva by the Rio Tinto-Huelva railway, a single-gauge line 84 kilometers, or 51 miles, in length, built by the company, in 1873. This line does a general freight and passenger business, in addition to handling the company's heavy traffic, and earned net profits of £14,694 in 1901, while the 1905 business was heavier than ever previously. At Huelva, which probably is built on the site of the old Phœnician city of Onoba, at the junction of the Tinto and Odiel rivers, known to the Phœnicians and Carthaginians as the Urium and Anas rivers, the company has extensive railway terminals and wharves, the latter recently remodeled and enlarged, while further improvements are contemplated. The Rio Tinto company owns the steamer Don Hugo, of 1,249 tons registered burden, plying between Spain and Wales.

The Rio Tinto employs nearly 1,100 men, in Spain, of which number, about 60 members of the staff are British, the balance being native workmen the latter earning average wages of 15 reals, equal to about 60 cents, per day of 8 and 9 hours. There is no Sunday work and the men are paid daily, the labor being docile and giving very efficient and satisfactory workmen, in all grades. The population of the dual mining township of Rio Tinto-Nerva is about 27,000, and of the port of Huelva 24,000, hence it is estimated that the Rio Tinto Co., Ltd , is the direct source of support of 50,000 people in Spain, and indirectly supports perhaps half as many more in Spain, England and upon the Continent.

The company has maintained extensive smelters and acid works at Cwm Avon, Wales, for many years, but the old furnace-bottoms and rich slags at this plant are being resmelted, and the works cleaned up, preparatory to surrendering the lease, during 1906. New and more modern reduction works and acid plants have been built at Port Talbot, and will become the only works of the company, receiving ores direct from Spain.

Extraction of ore, 1905, was 627,366 long tons of cupriferous pyrites for shipment, and 1,202,768 long tons of ore for local treatment, a total of 1,830,104 tons, compared with 1,948,819 tons in 1904. The sales of washed ore disposed of for sulphur contents amounted to 308,000 long tons, in 1905, as against only circa 100,000 tons in 1903, this branch of the business showing a gratifying gain, that promises to prove permanent. Operations, during 1905, were hampered by a severe drought, causing a serious scarcity of water, indispensable in the leaching operations of the company, and 1906, because of a meager rainfall in the winter, is another year of aridity. Both years will show a reduced production of cement copper, but the balance will be restored later, none of the copper being lost, lack of water merely retarding the slow process of wet extraction. Production, 1905, was 72,307,200 lbs. fine copper, somewhat under normal, and 1906 will be low also, for the reason already given.

The management of Rio Tinto is excellent in all respects, the physical

handling of the mines and works being equal to the ability shown in the conduct of the company's finances. The mine scarcely requires commendation from a work of reference that was born in the Twentieth Century, for the Rio Tinto has been making copper for three thousand years, and the original expert who told King Hiram that the property was "merely a surface pocket, and would pinch out at little depth"—for such "experts" doubtless have existed since the Pharoahs began mining and smelting the metal—has filled an unhonored grave for lo, these thirty centuries.

RIO TINTO COPPER MINING CO. **WYOMING.**

Letter returned unclaimed from former mine office, Encampment, Carbon Co., Wyo. Organized September, 1902, under laws of Wyoming, with capitalization $1,000,000, by residents of Encampment, Wyoming, and Lincoln, Nebraska.

RIO TINTO GOLD & COPPER CO. **ARIZONA.**

Office: Grant Bldg., Los Angeles, Cal. Mine office: Prescott, Yavapai Co., Ariz. E. P. Thom, secretary; A. J. Varney, manager. Lands, 16 claims, in the Black Hills district, opened by two 70′ shafts, showing ore giving assays up to $15 per ton. Idle and reorganization rumored.

COMPAÑIA MINERA DE RIO TINTO MEXICANA. **MEXICO.**

Succeeded by Minas de Cobre de Rio Tinto.

RIO TINTO MINE. **BRITISH COLUMBIA.**

Letter returned unclaimed from former mine office, Beasley Camp, via Nelson, Kootenay district, B. C. A prospect, 7 miles west of Nelson, said to show sulphide ores carrying assay values of about $10 per ton. Idle for several years.

RIO VISTA GOLD & COPPER MINING CO. **CALIFORNIA.**

Office: 25 Nevada Blk., San Francisco, Cal. Mine office: Fair Play, El Dorado Co., Cal. E. F. Colgan, president; D. E. McKinlay, vice-president; F. H. Hood, secretary and general manager; A. G. Burnett, treasurer. Organized January, 1901, under laws of South Dakota, with capitalization $1,000,000, shares $1 par.

Lands, 2 patented claims, area 40 acres, known as the Consumnes mine, on the Consumnes river, 3 miles from Fairplay, opened by a 400′ shaft, showing a 23′ vein carrying a 4′ paystreak of bornite, giving average assays of circa 15% copper and $10 in combined gold and silver values per ton. Mine has about 500′ of tunnels, the Volcano tunnel showing a 10′ vein carrying bornite, and a 400′ shaft having a steel gallows-frame. Equipment includes an air hoist and a 3-drill Rix air-compressor, using baby drills. Management plans a new dam and flume, to utilize water power, under a 250′ head, for a hydro-electric installation. Company was said to be building a 30-ton smelter, but same does not seem to have materialized. Property was idle, November, 1905, but management planned resuming work in the spring of 1906. Management is said to be composed of men of good standing, but apparently the company suffers from financial debility.

RIP VAN WINKLE MINE. **WYOMING.**

Office: care of Dr. I. R. Swigart, Laramie, Wyoming. Lands are in Carbon county, Wyoming.

RISING SUN COPPER MINING & SMELTING CO. NORTH CAROLINA.

Letter returned unclaimed from former office, 241 Equitable Bldg., Baltimore, Md.

E. RIVEROLL CO. ARIZONA.

Office: Los Angeles, Cal. Works office: Chloride, Mohave Co., Ariz. At last accounts was building a small copper matting furnace, for custom smelting.

RIVERSIDE COPPER CO. ARIZONA.

Letters returned unclaimed from former office, Phoenix, Ariz., and former mine office, Morristown, Maricopa Co., Ariz. J. M. Graybill, president; Isaac T. Stoddard, agent. Organized under laws of Arizona, with capitalization $2,000,000, shares $1 par. Lands, 2 patented and 6 unpatented claims, in the Vulture Mountains, showing self-fluxing carbonate ores. The Copper Bottom claim also shows a good body of slightly argentiferous galena. Moribund.

ROBLES GRANDE GOLD & COPPER MINING CO. NEVADA.

Letter returned unclaimed from former mine office, Goldfield, Esmeralda Co., Nev. Capitalization $300,000, shares $1 par. Lands, 6 claims, circa 5 miles east of Goldfield, opened by a 53′ shaft, said to show a 33′ vein, giving assay values of $4 to $32 per ton.

ROB ROY MINING CO. UTAH.

Office: care of Edward McGurrin, secretary and treasurer, Salt Lake City, Utah. Emanuel Rauch, president. Capitalization, $75,000. Lands, 4 claims, on Clipper hill, Bingham Canyon, Salt Lake county, Utah. Idle.

NEGOCIACION MINERA LA ROCA NEGRA. MEXICO.

Mine sold, circa 1903, to American-Mexico Mining & Development Co.

ROCK LAKE MINING CO., LTD. ONTARIO.

Liquidated, 1905, and property sold to Algoma Copper & Smelting Co.

ROCKLAND COPPER CO. BRITISH COLUMBIA.

Letter returned unclaimed from former mine office, Silverton, B. C.

ROCKLAND COPPER CO., LTD.

Office: 568, The Bourse, Philadelphia, Pa.

ROCKY MOUNTAIN CONCENTRATING & MILLING CO. COLORADO.

Mine office: Black Hawk, Gilpin Co., Colo. Edgar S. Moulton, manager, at last accounts. Ores carry gold, silver and copper. Has gasoline power, 25-stamp mill and 75-ton concentrator.

ROCKY MOUNTAIN COPPER CO. WYOMING.

Office: Marcellus, Mich. Letter returned unclaimed from former mine office, Encampment, Carbon Co., Wyo. Geo. W. Kroll, president; Earle R. Clemens, vice-president and general manager; Arthur E. Bailey, secretary; J. V. Goodwin, superintendent. Organized August, 1902, under laws of Wyoming with capitalization $100,000, shares 10c. par. Lands, 8 claims, area 160 acres, in the Upper Platte district, showing oxide and carbonate ores in gossan, opened by sundry pits and shafts, deepest 55′.

RODMAN MINING & MILLING CO. NORTH CAROLINA.

Letter returned unclaimed from former office, Brooklyn, N. Y. Has a

small mill on its property, in Guilford county, North Carolina. Presumably idle.

BERNARDINO RODRIGUEZ. **MEXICO.**

Office and mine: Mazapil, Zacatecas, Mexico.

SEVERIANO RODRIGUEZ. **MEXICO.**

Office and mine: San Pedro Ocampo, Zacatecas, Mexico.

ROGERS COPPER & IRON CO. **TENNESSEE.**

Office: McComb, Ohio. Letter returned unclaimed from former mine office, Ducktown, Polk Co., Tenn. C. H. Shuler, president; C. S. Hoskinson, vice-president; W. J Stark, secretary; C. C. Glecker, treasurer; J. A. Ewing, general manager. Organized June, 1902, under laws of South Dakota. Lands, 300 acres, carrying copper and iron ores.

ROGERS MINING CO. **COLORADO.**

Letter returned unclaimed from former mine office, Pearl, Larimer Co., Colo. Lands, 6 claims, area 110 acres, said to adjoin the Kurtz-Chatterton, opened by 135′ and 1,100′ crosscut tunnels, showing low-grade disseminated malachite, azurite and chalcopyrite. Is controlled by the National Mining & Milling Co.

ROGUE RIVER MINING & SMELTING CO. **OREGON.**

Mine office: Grants Pass, Josephine Co., Ore. A. Pearson, superintendent. Property is to be a 100-ton furnace, at Savage Rapids, on Rogue River, near Grants Pass. Management announced, at end of 1905, that smelter would not be installed until spring, owing to delay in manufacture.

LA ROMANERA GROUP. **SPAIN.**

Offices: care of M. Yglesias, owner, 2, Tokenhouse Bldgs., London, E. C., Eng. Mine office: Paimogo, Huelva, Spain. Group includes the San Vicente and other mines, showing several veins, largest circa 40′ wide at top, and wider at depth, carrying cupriferous iron pyrites, with gold and silver values.

RONQUILLO COPPER CO. **MEXICO.**

Office and mine: 2 Post Office Bldg., La Cananea, Sonora, Mexico. Employs 25 men. A. D. Nanney, president; G. C. Eastman, vice-president and superintendent; P. J. Tehaney, secretary. Organized August 31, 1905, under laws of Arizona, with capitalization $1,000,000, shares $1 par. Mexican corporation is the Ronquillo Mining Co., S. A.

Lands, 82 pertenencias, including the Ronquillo group of 72 pertenencias, 4 miles from Janoverachi, 8 miles south of Cananea and ½ mile from the Sonora river, also 10 pertenencias known as the Swansea mine, adjoining the Cobre Grande mine of the Greene Consolidated, at La Cananea. The Ronquillo group has sufficient timber for mining use for some time to come, and fuel is abundant on the surrounding hills.

The Ronquillo mine shows antigua workings, on a vein up to 40′ width, traceable nearly one mile, carrying cuprite, melaconite, malachite and azurite near surface, with an iron-porphyry gangue. Development is by tunnel and 3 shafts, of which No. 1 shaft, 71′ deep, shows 40′ of ore at the bottom, averaging 13% copper. No. 2 shaft, 32′ deep has given ores assaying up to 35% copper. Both Nos. 1 and 2 shafts were abandoned on account of soft ground.

No. 3 is the main working shaft, and is being sunk in the country rock, with 2 compartments, and was circa 100′ deep at the close of 1905. Crosscuts will be driven at a depth of circa 300′. Water in this shaft is strongly impregnated with copper, and the ores carry fair gold and silver values. Water for mine purposes and potable use is secured from springs, 300′ from the main shaft. Nearest railroad is at La Cananea.

The Swansea mine is opened by a tunnel, showing an ore body of circa 75′ width, of concentrating grade, and considerable ore has been stocked on the dump. Equipment includes steam plant and air-compressor, and buildings include a store and 2-story stone office building. Company is said to plan building a mill for the Swansea mine.

RONQUILLO MINING CO., S. A. **MEXICO.**

Is the Mexican corporation of the Ronquillo Copper Co.

ROOSEVELT GOLD & COPPER MINING CO. **ARIZONA.**

Office: care of W. G. McDonald, president and general manager, P. O. Box 477, Bisbee, Ariz. Property, 15 miles fom Ft. Thomas, Graham county, on the Gila Valley, Globe & Northern railway, is developed by a 60′ shaft showing cuprite, malachite, chalcocite and chalcopyrite, of good assay values. Presumably idle.

RØROS KOBBERVÆRK. **NORWAY.**

Mine office: Rōros, Trondhjem, Norway. Employs 600 men. Property is a group of old mines, including the Storvarts, Kongens, Kristian VI, Muggruben and Arvedals Grube, partly owned by the government. From A. D. 1646 to 1897, this group of mines produced 73,000 metric tons of fine copper, and to the same date exported 260,000 tons of pyrites, the aggregate value of production to that date being upwards of $35,000,000. Ore is chalcopyrite at the Kongens and Arvedals groups, and elsewhere is cupriferous iron pyrites. Ore ranges in copper tenor from 4.5% to 5% in the Kongens group, circa 5% in the Muggruben and 6% to 7% in the Storvarts. The property is operated by power from a new hydraulic installation.

Production 1904, was 18,000 metric tons smelting ore, giving average returns of a trifle better than 4% copper, and 11,000 tons iron pyrites, exported for sulphur contents, giving a production, 1904, of 1,641,920 lbs. fine copper. Production for 1905 is estimated at 1,750,000 lbs. fine copper. Recent improvements should lead to a considerable increase in the production of copper, and also of pyrites for export.

ROSA AMARILLA COPPER CO. **MEXICO.**

Office: 33 Portland Blk., Chicago, Ills. Mine office: Pueblo Nuevo, Jalisco, Mex. A. L. Dewar, president; Danl. Campbell, vice-president; F. W. Harnwell, secretary; L. E. Fuller, treasurer; John Mann, superintendent; John A. Kruse, engineer. Organized 1904, under laws of Maine, with capitalization $5,000,000, shares $1 par. Is organized under laws of Mexico as the Rosa Amarilla Copper Co., Sociedad Anonima. Lands, 5 groups, including the Rosa Amarilla and Ethel copper groups, and the Talpurito silver group, area circa 300 acres, circa 30 miles southwest of Autlán, also the right, for three years, to prospect and locate claims within an

area of 30 kilometres square, or nearly 400 square miles. Company has 3 water rights denounced, and has leased a timber tract of 1,800,000 acres, which can furnish timber at practically the cost of cutting.

Lands show 4 ore bodies, probably lenses, averaging 100′ and upwards in width, with outcrops traceable for several miles. An average of upwards of 300 assays gives 7.8% copper, 6 oz. silver and a trace of gold, from oxide, carbonate and sulphide ores. Development is by two shafts, deepest 105′, at last accounts, and by 4 tunnels, in addition to which some diamond drilling has been done. Property is 26 miles from the Pacific and company controls a harbor known as Puerto de Natividad. A road between the mine and port can be built with a grade not exceeding 4% at any point, and averaging about 100′ per mile. Coke from Japan can be delivered at the dock for about $8 per ton.

COMPAÑIA MINERA ROSARIO. **ARGENTINA.**

Property is located in the Calamuchita district, circa 60 miles southwest of Córdoba, Argentina. Ore body is iron pyrites, carrying chalcopyrite, with quartz gangue, averaging 5% to 6% copper. Has a smelter with a 36″ blast-furnace, making matte averaging 65% copper and 30 oz. silver per ton, which is sent to Great Britain for reduction and refining, when mine is working. Presumably idle

MINA EL ROSARIO. **CHILE.**

Mine office: Tamaya, Ovalle, Chile. Is owned by the Familia Lecaros. Mine, opened 1850, is about 550′ deep. Idle for several years.

ROSEMAN GROUP. **CALIFORNIA.**

Office: care H. Roseman, Redding, Shasta Co., Cal. Lands, 9 claims and a smelter site. Property is slightly developed by shafts and tunnels, showing oxide and carbonate ores near surface, with sulphides at slight depth. Idle for several years.

ROSELLE MINING CO. **BRITISH COLUMBIA.**

Letter returned unclaimed from former office, Vancouver, B. C. Property was sundry claims on Haskins Mountain, Liard River division of the Cassiar district, British Columbia, said to show large bodies of low-grade zinc and copper ore.

ROSE MINE. **CALIFORNIA.**

Letter returned unclaimed from former mine office, Victor, San Bernardino Co., Cal. Mine, in the Morongo district, circa 45 miles southeast of Victor, shows auriferous and argentiferous copper ores, and has shipped a little hand-sorted high-grade ore.

ROSEMONT COPPER CO. **ARIZONA.**

Office: care of Lewisohn Estate, 42 Broadway, New York. Mine office: Rosemont, Pima Co., Ariz. Geological conditions are said to be similar to those at Bisbee, and ore bodies apparently are large. Idle for several years, but said to have been bonded, early in 1906.

ROSEWOOD CREEK COPPER & GOLD MINING CO., LTD. **AUSTRALIA.**

Offices: 7A. Upper St. Martin's Lane, London, W. C., Eng. R. K. Evans,

secretary. Organized July 31, 1903, as reconstruction of the Great Northern Copper & Gold Mining Co. of Queensland, with capitalization £150,000, shares 5s. par. Lands, 265 acres, in the Rosewood goldfield, Queensland, Australia.

ROSSLAND-GREAT WESTERN MINES, LTD. **BRITISH COLUMBIA.**

Reorganized, May 17, 1902, as Rossland Kootenay Mining Co., Ltd.

ROSSLAND-KOOTENAY MINING CO., LTD. **BRITISH COLUMBIA.**

Offices: Salisbury House, London, E. C., Eng. Mine office: Rossland, B. C. C. Williamson Milne, chairman; Wm. Thompson, general manager; Bedford McNeill, consulting engineer; F. A. Labouchere, secretary. Organized May 17, 1902, as reconstruction of the Rossland-Great Western Mines, Ltd. and Kootenay Mining Co., Ltd., with capitalization £150,000, shares £1 par; issued, £148,607. Lands, 171 acres, carrying auriferous and argentiferous copper ores, of low grade. Idle since August, 1904.

ROSS MINING & MILLING CO. **COLORADO.**

Office: Ross Bldg., Waynesburg, Pa. Mine and works office: Silverton, San Juan Co., Colo. Employs 140 men. Timothy Ross, president; R. E. Clemson, vice-president; Frank L. Ross, secretary; J. B. Ross, general manager; Patrick Lonergan, mine superintendent; W. L. Hoyt, smelter superintendent; A. W. Harrison, engineer. Organized December 13, 1905, under laws of Colorado, with capitalization $2,500,000, shares $1 par; issued, $1,400,000. Financial statement, as of date May 23, 1906, gave assets of $561,750, including property, inventoried at cost, with liabilities of $192,500, including payments not yet due, on bond and lease, with $25,000 cash on hand and ore and supplies on hand, $30,000. Pittsburg Trust Co., transfer agent and registrar. Annual meeting, second Saturday in September.

Lands, 42 lode claims and 3 placer claims, area 300 acres, also 3 millsites, area circa 80 acres, with sundry miscellaneous lands, giving total holdings of 750 acres, in the Animas, Eureka and Red Mountain districts. Mining lands include 3 groups, known as the Champion, Belle Creole and Galtie Boy. Property is held under a working bond and lease, partly paid, from the San Juan Smelting & Refining Co.

The Champion group, which is on a productive basis, shows 3 fissure veins, in granite, opened by a 45′ shaft and by tunnels of 150′, 375′, 800′ and 1,700′, with a total of 2,550′ of workings, showing ore giving average assays of 5.5% copper, 25 oz. silver and $10 gold per ton. The Champion was opened circa 1885, and is equipped with a 75-h. p. steam plant, 5-drill Rand air-compressor and 7 mine buildings.

The Belle Creole mine shows two fissure veins, in andesite, of 20′ width and 1,600′ length, slightly developed by shafts of 15′ and 35′, and by tunnels of 75′ and 150′, showing low grade milling ore carrying circa 15% lead, 12% zinc, 15 oz. silver and $4 gold per ton. The property is practically without equipment.

The Galtie Boy shows 3 veins, occurring as fissures in andesite, these averaging 6′ width and traceable 3,000′, opened to a depth of 600′ by a 50′ shaft and by tunnels of 350′ and 2,500′, with total workings of 2,900′. Ore

gives average assays of 3% copper, 10% lead, 10 oz. silver and $5 gold per ton. Equipment is a 5-h. p. gasoline hoist.

The reduction plant, known as the Kendrick & Gelder smelter, is at Silverton, 1,500′ from the Champion, 2,000′ from the Galtie Boy and 3 miles from the Belle Creole mine, served by the Denver & Rio Grande and the Silverton, Gladstone & Northern railroads. Plant includes a 125-ton blast-furnace, employing 65 men, in three 8-hour shifts. Product is matte carrying 45% to 50% copper, circa 200 oz. silver and 3 oz. gold per ton, sent to the United States smelter, at Salt Lake, for refining. This plant does a general custom business.

The company plans extensive mining developments, during 1906, including the addition of electrical equipment at all mines, bringing the Belle Creole and Galtie Boy mines to a productive basis, building a 20-stamp mill at the latter and installing new power plants, with air-compressors, at both the Galtie Boy and Belle Creole. At the smelter it is planned to install a new 40x140″ blast-furnace.

ROUILLARD COPPER MINES. **NEW HAMPSHIRE.**

Mine office: Woodsville, Grafton Co., N. H. Property is on Mt. Gardner. Idle sinc 1902.

ROUSE-GARDNER MINING CO. **COLORADO.**

Mine office: Central City, Gilpin Co., Colo. J. W. Bostwick, manager. Property is the Gardner mine, carrying gold silver and copper ores. Has steam power.

ROUTT COUNTY GOLD & COPPER MINING CO. **COLORADO.**

Office: 635 Seventeenth St., Denver, Colo. W. T. Perkins, president; F. E. Coe, secretary and treasurer. Organized March, 1903, under laws of Wyoming, with capitalization $1,500,000, shares $1 par. Lands, 5 claims, area 50 acres, in Routt county, Colorado, 100 miles from nearest railroad, developed by about 1,000′ of tunnels, said to show a considerable quantity of ore assaying $3.50 to $150 per ton, in gold, silver, copper and lead. Idle.

ROWAN GOLD & COPPER MINING CO. **NORTH CAROLINA.**

Office: Salisbury, N. C. Alvin Merriam, superintendent. Property is the Oddie gold-copper mine, equipped with steam power, a 10-stamp mill and leaching plant, using the Mead process on concentrates.

ROYALBERG COPPER MINES, LTD. **NORWAY.**

Offices: 2, Basinghall Ave., London, E. C., Eng. Mine office: Kongsberg, Norway. E. T. Evans, secretary; Ingwolf Otterbeek, superintendent. Organized April 24, 1903, with capitalization £100,000, shares £1 par; issued, £81,600. Lands, 18 claims, area circa 50 acres, title by crown grant, also 20 acres timber lands, in the Fiskum district, opened by shafts of 40′, 70′, and 100′, and by tunnels of 120′ and 250′, showing four 3′ fissure veins in volcanic mica-schists, giving average assays of 14% copper, 20% lead, 10% zinc and 24 oz. silver per ton, from sulphide ores, and estimated to show 30,000 tons of ore, with 15,000 tons blocked out for stoping. The West Norway railroad is 2 miles distant, and it is proposed to develop 100 h. p. from a nearby

capitalization 1,500,000 pesetas, shares 500 pesetas par. Property includes the Leonor and adjoining mines, under investigation, at last accounts.

RUMAILLANA TUNNEL CO. **PERÚ.**

Mine office: Cerro de Pasco, Junin, Perú. Developement is by the Yauricocha and Mesapata shafts, suspended 1905, and by the Rumaillano or Meiggs drainage tunnel, planned to drain and open the entire Cerro de Pasca district. Tunnel was 1,200 meters long, August, 1905 and at that length no ore had been found.

RUSH & BROWN. **ALASKA.**

Office and mine: Kasaan, Alaska. Employs 50 men. U. S. Rush and George E. Brown, owners; R. W. Gibson, mine superintendent. Lands, 8 claims, area 160 acres, also a 15-acre millsite, on Kasaan Bay, in the Ketchikan district, showing country rocks of diorite, felsite, quartzite and conglomerate and chloritic schists, with occasional limestone, carrying chalcopyrite, associated with magnetite, in veins and in lenticular masses. There are 3 ore bodies, having a generally east and west strike, of which two, developed by shafts of 20′, 80′, and 80′, and by 3 tunnels, longest 160′, show an average width of 8′, giving ore assaying 3.5% copper, 1 oz. silver and $2 gold per ton. Management estimates 35,000 tons of ore in sight. Has a small steam hoist and several mine buildings. Mine is served by a tram, taking ore to wharfs at Venus Bay, 3 miles distant, where loaded on vessels and barges, for shipment to smelters.

MARCOS RUSSEK. **MEXICO.**

Office and mine: Jiménez, Chihuahua, Mexico.

RUSSELL UNITED COPPER CO. **ARIZONA.**

Dead. Lands sold, circa 1904, to Arizona Consolidated Mining Co.

MINA DE RUY GOMES. **PORTUGAL.**

Owned and operated by Companhia Mineira Alemtejana.

RUTHBERG CONSOLIDATED COPPER CO. **IDAHO.**

Letter returned unclaimed from former office, Banigan Bldg., Providence, R. I. Lands were 112 acres, in the Seven Devils district of Idaho.

RYE COPPER CO. **ARIZONA.**

Office: care of Chas. T. Martin, secretary, Globe, Ariz. Mine office: Rye, Gila Co., Ariz. E. F. Eisenhour, president and general manager. Organized 1905, under laws of Arizona, with capitalization $1,000,000, shares $1 par. Lands, 17 claims, well timbered and suitable for grazing, east of the Mazatzal Mountains, in a slightly explored district, circa 75 miles north of Globe and about the same distance south of Flagstaff. Country rock is diorite, with intrusive porphyry dikes, carrying contact veins showing sulphide ores associated with hematite, near surface. The mine has circa 1,000′ of workings, including shafts, tunnels and trenches. Property has an available water power, and the management plans installing a turbine wheel.

SACAJEWEA GOLD & COPPER MINING CO. **MONTANA.**

Office: 11 Broadway, New York. Mine office: care of W. J. Anson, secretary, Helena, Mont. Capitalization $5,000,000, shares $10 par. Colonel

Henry Altman, president. Lands, 47 claims, in vicinity of Helena, Lewis & Clark county, Montana.

SADDLE MOUNTAIN MINING CO. **ARIZONA.**

Office: 1008 F St., Washington, D. C. Mine office: Christmas, Gila Co., Ariz. Employs 200 men. Lewis S. Welch, president; Clarence Stephens, vice-president; Story B. Ladd, secretary; Wilbur W. Delano, treasurer; Geo. B. Chittenden, general manager; A. W. Hendricks, superintendent; Jas. H. Myers, smelter superintendent. Organized 1902, under laws of Arizona, with capitalization $1,000,000, shares $1 par. Debentures, $150,000 authorized, $140,000 issued, at 6%.

Lands, 1,500 acres, in process of patenting, in the San Carlos district of Gila county and the Saddle Mountain district of Pinal county, Arizona, of which 42 claims were located for copper and 14 claims for gold and silver, with 400 acres of coal lands. The principal group of copper claims is at the junction of Disappointment Valley with the Gila river, on the north side of the river, 15 miles east of Troy, 7 miles from Dudleyville and 8 miles from Winkelman, the present terminus of the Phoenix & Eastern railroad, and the nearest shipping point. Property was opened, 1883, by the San Carlos Copper Co., but was closed, 1884, because found to be located on the San Carlos Indian Reservation, and remained idle until the lands were restored to the public domain, by executive order of the president, December 2, 1902.

Country rocks are porphyry and limestone, latter in various stages of alteration, near the porphyry contact. Ore occurs in contact veins, and also as replacements in limestone, showing carbonate ore with garnetiferous gangue on the limestone wall, and sulphides along the porphyry contact, at depth. Four main ore bodies are being developed, these ranging from 4′ to 60′ in width, carrying estimated average values of 3% copper, 2 oz. silver and 50 cents gold per ton, from almost every commercial variety of copper ore, including cuprite, malachite, chalcocite, bornite and chalcopyrite, latter occurring disseminated in iron pyrites. Development is by shafts of 175′, 175′ and 330′, with several other shallow shafts of 50′ to 150′ depth, and by tunnels of 350′, 300′, 250′ and 200′, connected by drifts along the contact, and by tunnels of 600′, 100′ and 150′, unconnected, giving a total of about 2 miles of underground workings, exposing a large amount of ore, from which extraction, early in 1906, was 200 tons daily. The ore has been exposed by surface-cuts as well, and it is probable that a considerable amount of ore can be won open-cast. The mine has a 75-h. p. steam plant, including one 5x6″ hoist and two 6x8″ hoists, good for about 500′ depth, with 10 buildings for various uses.

The company's coal lands, in the lower basin of Deer Creek, show a 5′ vein of coal, apparently of coking grade, and the company may build coke-ovens and connect the mine and ovens with the smelting plant by an electric line.

The smelter, at the mines, receives ore by wagon and tram therefrom, and has a daily capacity of circa 225 tons. The old smelter, erected in 1884,

by the San Carlos Copper Co., had two small water-jacket blast-furnaces, which were used by present company for experimental purposes only, and have been torn down and replaced by a 150-ton Mitchell economic hot-blast furnace. Product is matte carrying 60% to 65% copper, 12 oz. to 14 oz. silver and 0.35 oz. gold per ton, shipped for refining to the Boston & Colorado smelter, at Denver, and to the Arizona Smelting Company's works, at Humbolt. A little custom smelting is done occasionally, to accomodate neighboring properties. The smelter was blown in, August, 1905, but interruptions of the coke supply, and floods on the Gila river, caused very irregular running, until January, 1906, since which time there has been some trouble with fuel supply, but coke for 2 months running was secured in April, and more regular operations are hoped for.

Production, 1905, was 450,000 lbs. fine copper, and the 1906 output is estimated by the company as likely to be 2,400,000 pounds. Ores smelted in 1905 gave average returns of 3% copper. Cost of mining was $2 per ton. The company plans bridging the Gila river, and continuing development on a fair scale. Management is good, and the property is of much more than average promise.

SADO MINE. **JAPAN.**

Owned by Mitsu Bishi Goshi-Kwaisha.

SAGINAW DEVELOPMENT CO. **ARIZONA.**

Merged, March, 1906, in American-Saginaw Development Co.

SAGINAW MINE. **ARIZONA.**

An old and idle copper mine, in the extreme foothills about 7 miles south of Tucson, Pima county, Arizona.

SAGINAW MINE. **MONTANA.**

Letter returned unclaimed from former mine office, Dillon, Mont.

SAGINAW MINING CO. **WASHINGTON.**

Mine office: Maple Falls, Whatcom Co., Wash. Has copper-gold ores.

SAGINAW VALLEY COPPER MINING CO. **WYOMING.**

Dead. Lands were lost, 1905.

SAHUARIPA EXPLORATION CO. **MEXICO.**

Mine office: Sahuaripa, Sonora, Mex. Lands are a number of properties in the Sahuaripa district, including the Mina Esperitu Santo, 12 miles east of Sahuaripa, opened circa 1842, and closed in 1900, owing to striking of water. This has a blanket vein of argentiferous and plumbiferous tetrahedrite, carrying up to 250 oz. silver per ton. Idle.

SAHUAYACAN MINING CO. **MEXICO.**

Office: Pittsburg, Pa. Mine office Jesús Maria Ocampo, Chihuahua, Mexico. Leo Reed, manager. Property includes the Veronica and other mines, carrying auriferous and argentiferous copper ores, developed by a 350′ main shaft. Has steam power and a 20-stamp mill, employing about 100 men, at last accounts.

ST. CROIX CONSOLIDATED COPPER CO. **WISCONSIN.**

Office: Superior, Wis. Organized 1903, under laws of Wisconsin, with capitalization $1,500,000, shares $1 par. Lands, 9 groups, area 22,000 acres,

in Douglas county, Wisconsin, carrying the western extension of the Keweenawan copper belt of Michigan. Idle.

ST. CROIX SECURITIES & DEVELOPMENT CO. **WISCONSIN.**

Office: 901-52 Broadway, New York. Hezekiah Holbert, president; E. B. Holbert, secretary; W. H. F. Holmes, superintendent.

ST. DAVID'S GOLD & COPPER MINES, LTD. **WALES.**

Succeeded, July 21, 1903, by St. David's Gold Mines (1903), Ltd.

ST. DAVID'S GOLD MINES (1903), LTD. **WALES.**

Offices: 29, Cornhill, London, E. C., Eng. Mine office: Barmouth, North Wales. G. C. Isaacs, chairman; E. T. McCarthy, consulting engineer; H. J. Nicholls, mine manager; J. Junner, secretary. Organized July 21, 1903, as a reconstruction of St. David's Gold & Copper Mines, Ltd., with capitalization £60,000, shares 5s. par; fully issued and 4s. 6d. paid in. Debentures, £40,000 authorized, £10,000 outstanding, at 6%. Lands, 800 acres, carrying gold and copper ores. Has a 50-stamp mill and an Elmore oil concentration plant. Paid dividends of 10%, 1904.

ST. EUGENE CONSOLIDATED MINING CO., LTD. **BRITISH COLUMBIA.**

Mine office: Moyie, East Kootenay, B. C. Is controlled by the Consolidated Mining & Smelting Co. of Canada, Ltd. Lands, 484 acres, with an extensively developed silver-lead mine. Equipment includes a 40-drill air-compressor, hoist, etc., and a 500-ton concentrator, putting about 5 into 1. Ore averages circa 12.5% lead and 7 oz. silver per ton, with an average value of $52 per ton. Production, for fiscal year 1905, was 40,462,141 lbs. lead and 1,029,820 oz .silver, with gross values of $1,820,011.53, giving a net profit of $575,827. Has paid dividends of $280,000 yearly, for some years.

ST. GEORGE COPPER MINING CO. **UTAH.**

Office: care of Clarence K. McCornick, president, Salt Lake City, Utah. Mine office: St. George, Washington Co., Utah. Capitalization, $400,000. Grant C. Snyder, secretary and manager; B. L. Cutler, superintendent. Lands, sundry claims, in the Dugway Mountains. Main shaft, 100′, on a 4′ to 5′ vein, giving assays of 4% to 40% copper. Has gasoline power and a small smelter, and is doing systematic development work and levying assessments. Management is good, and property is well regarded.

ST. JOE MINING CO. **UTAH.**

Office: 61 Commercial Blk., Salt Lake City, Utah. Mine office: Bingham Canyon, Salt Lake Co., Utah. R. A. Hasbrouck, president; Wm. S. Burton, secretary. Capitalization $1,000,000, shares $1 par. Lands, 17 claims, area 340 acres, developed by upwards of one mile of underground workings, including a tunnel one half mile long, at end of 1905, planned to be driven one mile, which is the second deepest working tunnel of the Bingham camp. A winze from this tunnel is said to show good ore. Litigation over titles was settled, circa 1905, in the company's favor, in the United States Supreme Court. Property is considered promising.

ST. JULIAN GOLD MINING CO. **MONTANA.**

Office: care of W. A. Bercry, president, 61 East Warren Ave., Detroit, Mich. Mine office: Chico, Park Co., Mont. J F. Nolan, manager. Lands

include the Bercry, Bullion and Copper Queen claims, carrying gold, silver and copper. Has steam power and an Elspass mill.

ST. LAWRENCE COPPER CO.

Organized March, 1905, under laws of New Jersey.

ST. LAWRENCE MINE. **MONTANA.**

Mine office: Saltese, Missoula Co., Mont. Lands, sundry claims, lying near the Richmond and Monitor mines, 6 miles southwest of Saltese, with ore opened on a vein lying parallel to that of the Richmond and Monitor.

ST. LAWRENCE MINE. **WASHINGTON.**

Office: 312 Trader's Blk., Spokane, Wash. Mine office: Twisp, Okanogan Co., Wash. Owned by W. R. Marvin, T. H. Boyd and P. F. McLaughlin. Lands, 4 claims, in the Twisp district, Cascade Mountains, Washington, circa 60 miles from a railroad, showing a strong vein giving assay values of about $40 per ton, in copper, gold and silver. Idle.

ST. LOUIS COPPER CO. **ARIZONA.**

Dead. Formerly had an office at 721 Olive St., St. Louis, Mo.

ST. LOUIS COPPER MINING & DEVELOPMENT CO.

Office: 706 Chestnut St., St. Louis, Mo.

ST. LOUIS MINE. **NEW MEXICO.**

Owned by Southwestern Copper & Iron Co. and leased to Burro Mountain Copper Co.

ST. LOUIS MINE. **WASHINGTON.**

Owned by Conservative Mining Co.

ST. LOUIS UNITED COPPER MINING CO. **NEW MEXICO.**

Letter returned unclaimed from former office, 313 North 9th St., St. Louis, Mo. Mine office: Jarilla, Otero Co., N. M. Property is the Garnet mine, said to be under lease to the Calaveras Mining Co., of Pittsburg, Pa.

ST. LOUIS-VASSAR MINE. **UTAH.**

Mine office: Park City, Summit Co., Utah. Robert Gorlinski, manager. Ores carry mainly silver, with fair values in copper, lead and gold. Idle.

ST. MARIE COPPER CO. **COLORADO.**

A swindle, perpetrated by John Reilly and W. W. Wilson, two notorious confidence men. Claimed to be incorporated under laws of Wyoming, and to have property near Leadville, Lake county, Colorado.

ST. MARY'S CANAL MINERAL LAND CO. **MICHIGAN.**

Entire stock issue is held by St. Mary's Mineral Land Co.

ST. MARY'S COPPER CO. **MICHIGAN.**

Wound up, circa 1899, and lands sold to Arcadian Copper Co.

SAINT MARY'S MINERAL LAND CO. **MICHIGAN.**

Office: 701-199 Washington St., Boston, Mass. Local office: Houghton, Houghton Co., Mich. Employs circa 60 men. Nathaniel Thayer, president; Chas. J. Paine and J. Henry Brooks, vice-presidents; Arthur G. Stanwood, secretary and treasurer; preceding officers, Samuel N. Brown, Albert S. Bigelow, Chas. E. Perkins, Geo. P. Gardner, Walter Hunnewell, Chas. N. King and Nathaniel H. Stone, directors; R. R. Goodell, local manager; Dr. L. L. Hubbard, consulting engineer; Rex R. Seeber, mine superintendent;

Wm. Skewes, mining captain. Organized March 4, 1901, under laws of New Jersey, with capitalization $5,000,000, shares $25 par; issued, $3,750,000. Company holds the entire stock issue, except founders shares, of St. Mary's Canal Mineral Land Co., organized 1863, under laws of New York, to take over lands given by the state for construction of the first ship canal at Sault Ste. Marie, lands so given being 180,000 acres in Houghton, Ontonagon and Keweenaw counties, and from which tracts the Calumet & Hecla, Tamarack, Baltic, Trimountain, Champion and other mines have been developed. Shares are listed on the Boston Stock Exchange. Old Colony Trust Co., Boston, registrar.

Lands, 95,839 acres in fee, and mineral rights to 14,216 additional acres, lands being scattered along the Lake Superior copper belt, with principal holdings on the South Range, southwest of Houghton. No lands were sold during 1905. Other assets are 50,000 shares of stock of the Champion Copper Co., being a one-half interest in that corporation; 55,000 shares King Philip Copper Co., being a control; 20,000 shares Pacific Copper Co., being a half interest, 208 shares Copper Range Consolidated Co., 842 shares Winona Copper Co., 80 shares Old Colony Copper Co., 25,000 shares Mayflower Mining Co. The company also owns the Challenge mine, outright. From 1863 to 1900 the old company paid cash dividends of $2,200,000, also stock dividends of one share Tamarack, one share Iroquois, 1½ shares Baltic, ½ share Winona and ½ share Albany & Boston, on each share of St. Mary's stock. The company is in receipt of a large income from the dividends of the Champion Copper Co. Dividends were $1 per share in 1903, $1 in 1904 and $2 per share in 1905. The company issued 10,000 shares, at $50, to shareholders, February, 1906, raising $500,000 for development of the Challenge and King Philip mines. During 1905 the company sold land, timber and wood to the value of $225,792, and ended the year with $177,295 cash on hand.

The Challenge mine, in Section 22, Town 53 North, Range 35 West, is circa 5 miles south of the Champion mine. Extensive diamond drill borings having located the southern extension of the Baltic amygdaloid bed, sinking was begun Sept. 10, 1904, and a vertical drop shaft was bottomed, in the ledge at a depth of 114′, in January, 1905. The vertical shaft, which will be replaced ultimately by an incline shaft, upraised from the permanent workings, at the permanent angle of the lode, was deepened to 300′, and the lode reached by crosscuts, the third level having been opened March, 1906. On the first level the drifts show a 13′ amygdaloid, of healthy appearance, showing large amygdules carrying considerable calcite, which evidently is the Baltic bed or its twin amygdaloid, fairly mineralized, but not up to the average Baltic values. Equipment at the Challenge includes a Parker horizontal water-tube boiler, maintaining a steam pressure of 150 lbs. per square inch, with wood as fuel. A new air-compressor and a Nordberg hoist, good for 1,500′ depth, were installed in March, 1906. The showing at the mine is decidedly promising.

Owing to the great extent of its lands, mainly located on the Keweenawan copper belt, and stretching along the mineral range for scores of miles, the

COMPAÑIA MINERA DE SAN ANTONIO. **MEXICO.**

Letter returned unclaimed from former mine office, La Cruz, Tamaulipas, Mex. Alex. Dozal, manager, at last accounts. Ores carry copper, lead and silver.

SAN BALTAZAR COPPER CO. **MEXICO.**

Office: 508 Germania Bank Bldg., Pittsburg, Pa. Mine office: Tlacolula, Oaxaca, Mex. J. Albert McKay, president; Hon. Pembrook R. Flitcraft, vice-president; Oscar A. Rogers, secretary; Andrew B. Berger, treasurer; Guillermo W. Thompson, general manager; Frank M. Lehmer, superintendent. Organized December, 1904, under laws of Maine, with capitalization $1,000,000, shares $10 par; issued, $780,000. Lands, sundry groups, area 700 acres, also a 40-acre millsite, in the Guelavilla and Tlacolula districts, 8 miles south of the ruins of Mitla. Country rocks are porphyry and limestone, carrying numerous contact veins or lenses, of which 6 are being developed, these having an average width of 8′, outcropping for 2 miles. At last accounts had a 50′ shaft, showing selected oxide and carbonate ores of 44% copper tenor, while assays of outcrops give 1% to 15% copper, 15 oz. to 20 oz. silver and from nothing to 16% lead. It is planned to develop mainly by tunnels. Property is considered promising.

SAN BARTOLO COPPER MINES, LTD. **CHILE.**

Voluntarily liquidated, 1903.

SAN BERNARDINO COPPER CO.

Organized March 8, 1899, under laws of West Virginia, with capitalization $2,500,000, $500 paid in, by J. B. Neily, et al, of Boston

SAN BERNARDINO MINING CO. **MEXICO.**

Office and mine: Schalk Bldg., La Cananea, Sonora, Mexico. Employs 15 men. A. S. Judd, president; J. L. Stroyick, vice-president and superintendent; J. M. Gibbs, general manager; B. N. Norton, consulting engineer. Organized under laws of United States and Mexico, with capitalization $500,000, shares $5 par. Lands, 144 pertenencias, 18 miles southeast of Cananea, 2 miles west of a railroad, in the Manzanal Mountains, developed by a 100′ shaft, showing a vein of 6′ average width, carrying auriferous copper ores that have given assays up to 30% copper, 70 oz. silver and $8 gold per ton. Small shipments, to the El Paso smelter, netted $93 per ton. Was worked, circa 1876, for silver, but suspended, owing to raids of Apaches. Property is considered promising.

SAN BERNARDINO MINING & MILLING CO. **ARIZONA.**

Office: care of Robert H. Skiles, secretary, Santa Ana, Cal. Mine office: care of Ray R. Radford, president and general manager, Douglas, Cochise Co., Ariz. Chas. Dolf, vice-president; C. W. McCoy, engineer; preceding officers, Chas. Crawford and L. A. Skiles, directors. Organized, June 24, 1904, under laws of Arizona, with capitalization $500,000, shares $10 par; issued, $250,000. Annual meeting, second Monday in June. Lands, 16 claims, area circa 300 acres, in the Ash Springs district, 9 miles from the El Paso & Southwestern railway, showing a contact vein between altered limestone and porphyry, opened by shafts of 64′, 53′, 58′ and 46′, and by

tunnels of 50′ and 120′, carrying ores that have given assays of 9% copper, with fair gold and silver values. Was developing by diamond drill, at last accounts.

SAN BERNARDO MINING CO. **MEXICO.**

Letter returned unclaimed from former office, Chicago, Ills. Mine office: Aduana, Sonora, Mexico. Mine is known as the Santo Domingo, and a shaft is being sunk between two veins, known as the Balvanera and Santo Domingo, which are expected to unite at depth. Ores give assays of 46 oz. silver, with small copper and lead values.

SAN CALLETANO MINING & SMELTING CO. **ARIZONA.**

Office: care of C. O'Brien Reddin, general manager, 121 Geary St., San Francisco, Cal. Mine office: Calabasas, Pima Co., Ariz. Lands, 12 claims, in 2 groups, in Santa Cruz and Pima counties, from which selected samples have given assays up to 9% copper, 400 oz. silver and $2.50 gold per ton.

SAN CARLOS COPPER CO. **ARIZONA.**

Lands are under bond to Saddle Mountain Mining Co.

SAN CARLOS COPPER CO. **MEXICO.**

Office: 25 Broad St., New York. Mine office: Linares, Nuevo León, Mex. Employed circa 800 men, at last accounts. W. H. Nichols, Jr., president; S. H. Steele, secretary and treasurer; Edw. D. Self, general manager. Organized 1896, under laws of New York, with capitalization $100,000, shares $1 par. Mining lands, 6 square miles, are in the San Carlos district of Tamaulipas, Mexico, with a smelter at San José, Tamaulipas. Company also owns 6,400 acres of timber lands. Veins are contacts between limestone and porphyry, and ores are oxides, carbonates, and sulphides, mainly the latter. Development is by upwards of 50 shafts and about 7 miles of tunnels, with total underground openings of about 10 miles. Nearest railroad is the Gulf branch of the Mexican Central, 38 miles distant, but it is planned to build a branch railway to the mines. Production, 1903, was officially reported by the Mexican government as 88.184 lbs. fine copper. which is very much under the usual estimates.

SAN CRISTOBAL COPPER CO. **NEW MEXICO.**

Office: 616-116 Broad St., New York. Mine office: Arroyo Seco, Taos Co., N. M. Richard Hopkins, president; B. F. Shakespeare, secretary; J. K. Turner, manager. Organized circa 1901, as successor of Rio Hondo Copper Mining Co. Lands, 1,850 acres, also sundry water-rights and a railroad franchise. Has an 80′ ore body, carrying copper, gold, silver and lead, opened by a 1,000′ tunnel. Has a smelter and cyanide plant. Original development was for copper, but recent operations have been confined, almost exclusively, to developing a big ledge of gold-bearing quartz.

SAN DOMINGO GOLD & COPPER CO. **ARIZONA.**

Merged, circa 1903, in Picacho Blanco Mining Co.

MINAS SAN DOMINGOS. **PORTUGAL.**

Owned by Mason & Barry, Ltd

SAN FELIPE MINING CO. **MEXICO.**

Office: Philadelphia, Pa. Organized 1902, under laws of Arizona, with capitalization $1,000,000, shares $1 par. Lands, said to be in the state of Jalisco, Mexico. Has paid dividends from stock sales, hence, is viewed with deep suspicion.

SAN FERNANDO COPPER MINING & SMELTING CO. **MEXICO.**

Offices: 3637 Fourth St., San Diego, Cal., and care of Woods Investment Co., Colorado Springs, Colo. Mine office: Ensenada, Baja California, Mexico. F. M. Woods, president; H. E. Woods, vice-president; Warren Woods, treasurer; John V. Smale, general manager.

Lands, 180 pertenencias, area 445 acres, in the San Fernando district, circa 240 miles below the California line, 25 miles east of San Carlos Landing, on the Pacific, and 80 miles southeast of the harbor of San Quentin, with a good wagon road from mine to the landing. Mine was discovered by the San Franciscan friars, early in the Nineteenth Century, and is said to have produced upwards of $500,000, from ore shipped, via San Francisco, to Liverpool, ore ranging as high as 50% in copper tenor, with good gold and silver values. Property shows numerous veins of 3′ to 5′ width, carrying carbonate ores and chalcocite at surface, changing at depth to chalcopyrite. Shipments by present owners average 20% copper. Equipment includes a hoist, pumps and laboratory. A small force is being worked, on development, and the company is said to plan erecting a smelter.

MINA SAN FRANCISCO. **MEXICO.**

Office and mine: care of D. Alberto Palos, owner, Tapalpa, Jalisco, Mexico. Property, 10 miles south of Virginia Camp, shows a vein carrying copper in small percentages, and gold at the rate of about $20 per ton, presumably from ores taken from a gossan capping.

MINA SAN FRANCISCO. **MEXICO.**

Mine office: care of G. V. Monteverde y Ca., owners, Pesqueira, Sonora, Mex. Ores carry gold, silver, lead and copper. Presumably idle

MINA SAN FRANCISCO. **PERÚ.**

Owned by Compañía Minera Santa Ines y Morococha.

NEGOCIACION MINERA SAN FRANCISCO y ANEXAS. **MEXICO.**

Mine office: Mineral de Asientos, Aguascalientes, Mexico.

COMPAÑIA MINERA DE FRANCISCO DEL AZUL. **MEXICO.**

Mine office: Matehuala, San Luis Potosí, Mexico.

SAN FRANCISCO DEL ORO MINES, LTD. **MEXICO.**

Offices: 65, London Wall, London, E. C., Eng. Mine office: Parral, Chihuahua, Mex. Earl of Denbigh, chairman; Rowland C. Fielding, consulting engineer; James Hyslop, mine manager; H. A. Searle, secretary. Organized April 18, 1903, with capitalization £375,000, shares £1 par; issued, £280,217. Lands, 253 acres, carrying gold, silver, copper, lead and zinc ores, undergoing development. Shipments are made to nearby smelters, and profits earned in first 18 months are given by company as in excess of £22,000. Company proposes building a reduction plant at the mines.

SAN FRANCISCO MINING CO. **MEXICO.**

Mine office: Autlán, Jalisco, Mexico. L. E. Fuller, president. Organized 1905, to operate in the Autlán district.

SAN FRANCISCO MINING CO. **MEXICO.**

Office: care of J. G. Pritchard, vice-president and general manager, Bisbee, Ariz. Mine office: Arizpe, Sonora, Mexico. H. M. Whitney, president; Fred C. Hagen, secretary; W. E. Tester, assistant secretary; J. W. Wood, treasurer; Peter Pitz, superintendent. Organized October 23, 1905, under laws of Arizona, with capitalization $60,000 shares $10 par. Lands, 16 pertenencias, also exploratory rights over 4 square miles of adjacent lands. Property shows several veins of 30″ to 9′ width, giving good assay values, mainly in gold and silver, with from a trace to 7.19% copper, and up to 50% lead.

FINCA SAN JOAQUIN. **CUBA.**

An old and idle mine, about 30 miles northeast of Cienfuegos, Cuba, worked intermittently, 1856-1885. Ores were shipped to Swansea and the United States for smelting, and are said to have returned an average of nearly 20% copper. Vein ranges up to 30′ in width, carrying cuprite, melaconite, azurite, bornite and chalcopyrite.

MINA SAN JOSÉ. **CHILE.**

Mine office: care of Silva y Rivas, owners, Tamaya, Ovalle, Chile. Mine, opened 1844, was 517′ deep, at last last accounts.

SAN JOSÉ CONSOLIDATED MINING CO. **MEXICO.**

Mine office: Nocozari, Moctezuma, Sonora, Mex. Organized under laws of Arizona and protocolized in Mexico. Lands, circa 100 acres, lying near the Moctezuma Copper Co., showing a vein of 5′ to 12′ width, carrying values mainly in silver and lead, with small gold and copper values.

SAN JOSÉ MINING CO. **CUBA.**

Succeeded, circa 1902, by El Cobre Mines.

MINAS SAN JOSÉ, SAN MIGUEL y EL BRUJO. **SAN SALVADOR.**

Office and mines: care of Luna Hermanos, owners and managers, Metapán, San Salvador, Central America. Ores carry copper, gold and silver. Have steam power and a smelter, employing circa 250 men, at last accounts.

COMPAÑIA MINERA SAN JUAN. **MEXICO.**

Mine office: Puerto de Muleje, Baja California, Mexico.

MINA SAN JUAN. **CHILE.**

Mine office: Copiapó, Atacama, Chile. D. Tomás Marambio, owner. Deepest shaft, circa 1,800′. Was worked originally for silver, but copper values predominate at depth.

MINA SAN JUAN. **SPAIN.**

Mine office: Paimogo, Huelva, Spain. Don José De Soto, manager. Lands, 102 hectareas, including 4 old mines. Presumably idle.

MINA SAN JUAN DE MALAJA. **CUBA.**

A promising prospect, with a 100′ gossan capping, about 6 miles northeast of Santa Clara, Cuba

SOCIEDAD MINERA SAN JUAN. **CHILE.**

Office: Calle Prat, 55, Valparaiso, Chile. Mine office: Higuera, Coquimbo, Chile. Employs 170 men. Guillermo Lyon, president; José Maria Muñoz, R., managing director; preceding officers E. A. Sandiford, Ruperto Alvarez and Cirilo Armstrong, directors; Miguel Scantlebury, general manager; Ricardo Spargoe, mine superintendent; Ricardo Everett, smelter superintendent. Organized under laws of Chile, with capitalization $1,000,000, Chilean, par $20, paid in $10, in $300,000 preferred and $700,000 common stock. Semi-annual meetings are held March and September.

Lands, 29 claims, area 66 hectareas, also a 9-hectarea millsite, in the Higuera district. Country rocks are granite and diorite, showing 8 strong parallel veins, opened by a large number of tunnels and by the following shafts: Casas, 70′; Ajo, 500′; Aguilas, 240′; Rosario, 300′; Cocinera, 240′; Capriciosa, 700′; San Juan, 1,200′; Ierma, 200′; San Pablo, 600′. Mines are estimated to have 20,000 tons of ore blocked out for stoping.

Mines were opened 1820, and have been in continuous operation since. The power plant includes 6 hoists, aggregating 180 h. p., good for 1,000′ depth, 7 driving engines, and a Siemens & Halske electric plant for lighting purposes and for driving 4 electric rock drills, of the same make. Buildings include a 100x100′ machine-shop, a 30x30′ carpenter shop and a 30x30′ smithy, all of wood, and about 50 dwellings for employes.

Company has two smelters, one at Las Casas mine, and the other, which is the more important, in a valley below and about one mile distant from the mines, from which ore is received in carts. The two smelters have a combined capacity of 230 tons daily. Equipment includes 12 kiln calciners, a 120-ton rectangular blast-furnace and seven 16-ton reverberatory furnaces. Product is a matte of 50% average copper tenor, sent to the works of the Sociedad Chilena de Fundiciones, at Guayacán, for refining. Nearest shipping point is the port of Potoralillo distant 9 miles from the smelter. Fuel is soft coal, costing $30, Chilean, per ton, and coke, costing $35 per ton, Chilean. Average cost of mining is $3 Chilean, per long ton, and of smelting, $10, Chilean, per ton. Ores treated average 8% copper. Production, first 5 months of 1906, was circa 1,000 tons fine copper, and for 1905 is estimated at 4,750,000 lbs. fine copper.

SAN JUAN MINING CO. **COLORADO.**

Mine office: Central City, Gilpin Co., Colo. J. I. Perkins, manager, at last accounts. Ores carry gold, silver and copper. Has steam power.

SAN JUAN SMELTING & REFINING CO. **COLORADO.**

Property bonded, December 13, 1905, to Ross Mining & Milling Co.

MINAS SAN LORENZO y ALLENDE. **MEXICO.**

In the Ures district of Sonora, Mexico. Frederick A. Platt, owner. Lands, 36 pertenencias, area circa 90 acres. The San Lorenzo has a 4′ vein, assaying as high as 18% copper and 30 oz. silver per ton. The Allende is not so rich, but is said to be a promising property. Presumably idle.

COMPAÑIA BENEFICIADORA SAN LUIS. **MEXICO.**

Works office: San Luis de la Paz, Guanajuato, Mexico. The smelter

is known as the Ojo de Agua. Production, 1903, was 29,054 lbs. fine copper.

COMPAÑIA MINERA SAN LUIS. **MEXICO.**

Property, at Tepezalá, Aguascalientes, Mexico, sold to Aguascalientes Metal Co.

SAN LUIS MINING CO. **MEXICO.**

Office: 27 William St., New York. Mine office: Gabriel, Durango, Mexico. Employs 1,000 men. Walter S. Logan, president; W. J. Robinson, vice-president; Myra B. Martin, secretary and treasurer; preceding officers, Seymour W. Tulloch, Angel L. Negrete, J. Edward Layne, Walter S. Perry and Col. Britton Davis, directors; Louis Ross, general manager; W. Tomás Moore, assistant manager; Lloyd Roby, superintendent; Andrew Macfarlane, mine superintendent; H. G. Elwes, mill superintendent; Sydney D. Tyler, engineer. Organized November 16, 1900, under laws of West Virginia, and capitalization increased, 1905, to $3,000,000, shares $1 par. Statement, as of date January 1, 1906, by company, gives liabilities of $44,068.70 and cash on hand $35,450, with $44,600 due the company. Annual meeting, second Wednesday in April. First dividend, 1%, was paid January, 1906, and a second dividend in July, 1906.

Lands, 64 groups of claims, area 1,241 acres, also a 25-acre millsite, 35,000 acres of timber and grazing lands and 8,000 acres miscellaneous lands, in the San Lucas and Panuco de Coronado districts of Durango. Miscellaneous holdings include El Cura ranch, of 35,000 acres, which furnishes mine timber, cereals and vegetables for workmen, and is being stocked with cattle. During 1905, mineral lands of 160 acres area were bought, giving total holdings of 506 claims, at end of the year.

Country rocks are limestone and porphyry, carrying fissure and contact veins. The different properties of the company show 64 veins of various sizes, degrees of mineralization and promise, of which 6 are being developed, these being estimated by company to carry an average of 3% copper, 12% lead, 1% zinc, 35 oz. silver and $4 gold per ton, mainly from sulphide ores, the various mines having 3 miles of underground workings, estimated to show 300,000 tons of ore, with 200,000 tons blocked out for stoping. The estimate of average values is more conservative than previously given by the company, and presumably is more nearly correct. Mines were discovered circa A. D. 1650, and were worked, more or less irregularly, until 1830, when closed on account of water and Indian troubles, until reopened, 1901, by the present company.

The San Luis mine shows a large body of copper ore, mainly low in grade, but with some high grade silver ore. During 1905, 2,153′ of development work was done in this mine, and for all properties, development during 1905 was 6,675′, giving a total of 17,314′ of workings, at the end of the year.

The Potosina mine had 1,994′ of development work in 1905. The western end of this mine shows a considerable body of ore of smelting grade, and a large quantity of milling ore, the sixth level making an exceptionally good showing. A new hoist is to be added and 2 more levels opened.

The San Gonzalo mine was 350′ deep in August, 1905, showing ore of

SOCIEDAD MINEIRA DE SAN MIGUEL DE HUELVA. **SPAIN.**

Succeeded, October, 1904, by San Miguel Copper Mines, Ltd.

COMPAÑIA MINERA DE SAN MIGUELITO. **MEXICO.**

Mine office: Cumpas, Moctezuma, Sonora, Mexico.

MINA SAN PEDRO. **ARGENTINA.**

Owned by Famatina Development Corporation, Ltd.

MINA SAN PEDRO. **MEXICO.**

Mine office: Cedral, San Luis Potosí, Mexico. J. A. Arbide and Roberto Yrizar, owners.

SOCIÉTÉ ANONYME DES MINES DE SAN PEDRO. **SPAIN.**

Office: Rue de Chateaudun, 39, Paris, France Mine office: Zalamea La Real, Huelva, Spain. Don Carlos Marchal, agent. Capitalization, 450,000 francs. Lands include the Barranco de los Buyes group of 10 old mines, area 167 hectareas.

SAN PEDRO COPPER CO. **NEW MEXICO.**

Mine office: San Pedro, Santa Fé Co., N. M. Idle for several years.

COMPAÑIA MINERA DE SAN PEDRO DE NOLASCO. **CHILE.**

Mine office: San Pedro de Nolasco, Victoria, Chile. Owns the Carlotta mine, opened A. D. 1795, which is developed by a 700′ tunnel.

MINA SAN PIO. **MEXICO.**

Office: care of Spencer C. Richardson, owner, 40 Water St., Boston, Mass. Is located 12 hours' horseback ride southwest of Ameca, Jalisco, Mex.

MINA SAN PLATON. **SPAIN.**

Office: care of Don Antonio Ruiz Cancela, Sevilla, Spain. Mine office: Almonáster, Huelva, Spain. Lands, 46 hectareas. Idle for several years.

SAN RAFAEL COPPER MINING CO. **MEXICO.**

Letter returned unclaimed from former office, Tucson, Ariz. Mine office: Hermosillo, Sonora, Mexico. Organized under laws of Arizona, with capitalization $1,500,000. Lands, 200 pertenencias, including the Randolph and other mines, 16 miles northeast of Hermosillo, having about 1,100′ of development work. Company was said to plan building a smelter, to have 2 reverberatory furnaces.

SAN RAFAEL MINING CO. **MEXICO.**

Office and mine: Ameca, Jalisco, Mexico. Lands, sundry claims, circa 21 miles west of Ayutla, two days' ride by trail from Ameca, lying on the eastern slope of the Cacoma ridge. Topography is rugged, and claims are well located for development by tunnel. The mountains show a wide belt of parallel veins, with quartz gangue, traversing diorite. Mine is an antigua, carrying values mainly in lead, zinc and silver. Equipment includes a water power installation, 5-stamp mill, cyanide plant and patio.

SAN REMO COPPER CO. **ARIZONA.**

A spectral corporation, organized under the laws of West Virginia, as the astral body of the Copper Belle Mining Co., with capitalization $300,000, later increased to $2,000,000, without the knowledge or consent of the shareholders, which once had, or was supposed to have had, some sort of a claim to

three claims of some sort, in the Dragoon Mountains, Cochise county, Arizona. Diaphanous.

HACIENDA DE SANTA BARBARA. **PERÚ.**

Works office: Yauli, Junin, Perú. Dr. O. Valentine, manager; B. F. Slater, superintendent. Property is a reduction plant located 6 miles from Morococha by trail, and circa 25 miles from the same point by rail. Ore is delivered by llamas, carrying 100 to 110 pounds each, at a freight rate of $2 to $2.50 per ton, with which rate the railroad, owing to heavy grades and heavy capitalization, cannot compete. Equipment includes a 20-ton Krupp ball mill, jigs, spitzkasten, centrifugal separators, centrifugal dryer, 6′ pulp-mill and a Van Meter oil concentrator. Plant is operated by a 60-h. p. turbine.

MINA SANTA BEATRIZ. **MEXICO.**

Mine office: care of Richard Pearce, superintendent, Magdalena, Sonora, Mexico. Has steam power. Presumably idle.

SANTA CECILIA COPPER MINING CO., LTD.

Wound up, July, 1901.

SANTA CRUZ COPPER CO. **MEXICO.**

Mine office: Santa Cruz, Arizpe, Sonora, Mexico.

SANTA CRUZ MINING CO. **ARIZONA.**

Office: 368A Live Stock Exchange, Kansas City, Mo. Mine office: Patagonia, Santa Cruz Co., Ariz. Employs 25 men. W. W. Hall, president; W. B. Barnes, vice-president; Geo. W. Bolen, secretary and treasurer; Wm. M. Schwartz, general manager; J. A. Tustin, superintendent. Organized October 5, 1901, under laws of Arizona, with capitalization $1,000,000, shares $1 par.

Lands, 6 claims, area 124 acres, in the Harshaw district, showing several fissure veins, of about 20′ average width, giving a general average assay of 8.5% copper, 20 oz. silver, 5.09% nickel and $25 gold per ton, mainly from chalcocite. Development is by 2 shafts, deepest 150′, at last accounts, but supposed to be sinking for the 500′ level. Mine was discovered 1860, opened 1890, reopened 1900, and after a period of inactivity work was resumed January 1, 1906. Management considered good, and property of promise.

SANTA EMILIA COPPER CO. **MEXICO.**

Office: 69 Wall St., New York. Mine office: Coapa, Michoacán, Mexico. Employs 60 men. A. J. Peyton, president and general manager; Geo. W. Lockwood, vice-president; Manuel L. Ward, secretary and treasurer; Jos. G. Collinson, superintendent; J. R. Crum, engineer. Organized 1899, under laws of Delaware, with capitalization $1,000,000, and reorganized January, 1905, under laws of Maine, with capitalization $2,000,000, shares $1 par. Of the increase in stock, $500,000 was given shareholders as a stock dividend, and $500,000 in shares placed in the treasury, for development purposes.

Lands, 113 acres, in the Tacambara district, including a 30-acre property adjoining the original tract, taken over from the president and paid for in shares from the new treasury stock. Property is 24 miles from nearest station on the Mexican National Railroad, but A. J. Peyton & Co. are said to be building a railway to within 3 miles of the mines. Principal development is by the Napoleon tunnel, 1,200′ long, and by a 600′ 2-compartment shaft. Equipment

includes a good steam plant, mine buildings, and accommodations for workmen. At last accounts mines were undergoing development, without showing ore in payable quantities, but conditions were considered encouraging, by the management.

SANTA EULALIA MINING & MILLING CO. **MEXICO.**

Office: 12 State St., Chicago, Ills. Mine office: Velardeña, Durango Mex. Conrad Auw, president; Henry Grant, secretary; Wm. J. Auw, manager. Has a 325′ main shaft and a 220′ tunnel, developing ores of lead, copper, gold and silver. Has gasoline power. Employed circa 100 men, at last accounts.

MINA SANTA FÉ. **MEXICO.**

Mine office: Teapa, Tabasco, Mexico. This mine, formerly held by the Chiapas Mining Co., is developed by a 1,560′ tunnel and a 200′ main shaft, showing a mineralized zone of circa 100 meters width, as a contact vein between diorite and limestone, apparently formed by contact metamorphism. Values are mainly in argentiferous and auriferous copper ore, but the ore is very complex, carrying cuprite, malachite, bornite, chalcopyrite, tetrahedrite, chrysocolla, sphalerite, galena, and free gold, associated with iron pyrites, with a gangue that is mainly wollastonite, a silicate of calcium. The best grade of concentrating ore is mainly bornite, disseminated in a gangue of wollastonite and garnet crystals. Property has water power, a 30-stamp mill, 100-ton concentrator and 75-ton smelter, and in 1903 made 168,050 kgs. fine copper.

SANTA FÉ GOLD & COPPER MINING CO. **MEXICO.**

Mine offices: Alamos, Sonora, Mex., and El Fuerte, Sinaloa, Mex. Is controlled, through stock ownership, by International Copper & Gold Co. Lands, 8 groups, in the states of Sonora and Sinaloa. La Josefita group, area 50 hectareas, in Sonora, near the Sinaloa line, is said to show an 80′ ore body, giving assays of 25% to 28% copper, with a good surface showing. It is planned to develop this group by quarrying. La Australia group, 20 claims, near El Fuerte, Sinaloa, is opened by a 70′ two-compartment shaft, showing a 1′ paystreak of bonanza ore, assaying 15% copper and 1,212 oz. silver per ton. La Sorteo group, 10 pertenencias, 7 miles from San Bernardo, has a 30′ vein, opened by a 150′ tunnel, giving good assay values in gold, silver and copper. El Negro group, 14 pertenencias, carries gold and silver. The Piedregal group, 15 pertenencias, is a little east of El Negro. La Higuera group, 8 pertenencias, in Sonora, shows a 16′ paystreak in a 50′ vein, carrying mainly silver values. El Niño group, 10 pertenencias, 30 miles southwest of San Bernardo, gives good assay values in gold, silver and lead. The Zacatecas group, 10 pertenencias, carries gold.

SANTA FÉ GOLD & COPPER MINING CO. **NEW MEXICO.**

Office: 11 Broadway, New York. Mine office: San Pedro, Santa Fé Co., N. M. Idle. J. H. Susmann, president; E. H. Westlake, secretary and treasurer; Organized 1899, under laws of New Jersey, with capitalization $2,500,000, shares $10 par, as a reorganization of the original Santa Fé company, formed 1888, and bankrupt 1892. Present company began business with $500,000 cash; balance of assets, Jan. 1, 1905, was $150,283.24.

Annual meeting, fourth Tuesday in January. State Street Trust Co., Boston, registrar; Old Colony Trust Co., Boston, transfer agent.

Lands, 3,400 acres mineral property and 46,000 acres miscellaneous lands, latter including coal areas of promise, all in the old San Pedro land grant. Mine is opened by a single shaft, on a blanket vein of sulphide ore 150′ to 175′ thick, dipping at an angle of less than 15°. About half the ore body is workable, though low in grade. Ore smelted, 1901, gave average returns of 4.75% copper, $1.50 silver and $1.50 gold per ton, slags showing about 0.5% copper only. It has been alleged that mining and smelting costs were about $7 per ton of ore, but this figure undoubtedly is too low. Ore is silicious, requiring heavy iron and lime fluxes. The mine is said to have ore reserves of about 30,000 tons, blocked out.

The smelter, with two 125-ton furnaces, was blown in Jan. 1, 1901, and blown out in the following November. The mine and smelter are 21 miles from the Santa Fé Central Railroad, with survey made for a connecting line. Much trouble was experienced in smelting, from shortage of coke supply and inadequate transportation facilities. To operate the property to advantage, ore should be concentrated, to obviate the smelting of an immense amount of barren material, in both ore and fluxes, and proper railroad connections are imperatively demanded for profitable operations The only work done, since 1902, has been the boring of 543′ of diamond drill holes It has been said that the ore was worked out, but this does not seem possible. Property is considered promising, if given good transportation facilities.

SANTA FÉ MINING & REDUCTION CO. **NEW MEXICO.**

Letter returned unclaimed from alleged mine office, Santa Fé, N. M.

COMPAÑIA SANTA INES y MOROCOCHA. **PERÚ.**

Office: 193 Calle de Aparicio, Lima, Perú. Mine office: Morococha, Junin, Perú. Employs 120 men. Roberto Pflucker, president; Leopoldo Pflucker, vice-president; Porfirio Silva, secretary and treasurer; Vicente Pazos y Sacio, general manager; León Torres, mine superintendent. Organized under laws of Perú, with capitalization 1,200,000 sols.

Lands, 120 mining claims, area 240 hectareas, also the Hacienda Morococha, area 56 square kilometres, in the Tuctu district of Yauli, Junin, Perú. Mining lands carry sundry fissures and contact veins between diorite and limestone, these averaging about one metre in width and carrying values up to 25% copper, with average returns of circa 16% copper and 16 oz. silver per ton, from sulpho-arsenide ores of copper. The mines are opened by the Ausiliar tunnel of 300 metres, La Media Falda tunnel of 600 metres, and La Laguna tunnel of circa 800 metres length, with a total of about 3,000 metres of underground openings, estimated to show about 20,000 tons of ore, blocked out for stoping. Mine is operated by electricity, furnished by a 40-kw. Siemens & Halske generator, with 3 electric drills, and is served by the Ferrocarril Central de Perú, tracks of which touch the mine.

Country coal, costing about $9 per ton, is used for fuel, and cost of mining is given by company as averaging about $2.50 per ton. Product is dressed to an average copper tenor of about 25% and sold to the Casapalca

smelter for reduction. Production, 1905, was circa 3,600 metric tons of ore, carrying about 2,000,000 lbs. fine copper. Company planned building a 100-ton smelter, but at last accounts the property was under option to Messrs. Haggin & McKim, presumably for the Cerro de Pasco company.

MINA SANTA MARIA. **HONDURAS.**

An undeveloped property at Comayagua, Honduras, asserted to be a mountain of ore, ten miles in circumference, assaying 10% to 75% copper, which is a pretty stiff claim.

COMPAÑIA MINERA SANTA MARIA DE LA PAZ. **MEXICO.**

Office: 10 Cinco de Mayo, San Luis Potosí, S. L. P., Mex. Mine office: Matehuala, S. L. P., Mex. Pedro Barrenchia, president; Rafael G. Barrenchia, secretary; W. B. A. Dingwall, manager; José Torres, superintendent. Mines, extensively developed, carry auriferous and argentiferous lead and copper ores. Has steam, electric and gas power, Chilean mills, Blake crushers, smelter with two 40-ton furnaces, and a 300-ton concentrator. Employs circa 1,500 men, and is a considerable producer of lead and silver, with smaller by-products of gold and copper.

SANTA MARIA MEXICO MINING ASSOCIATION. **MEXICO.**

Office: Merrill Bldg., Milwaukee, Wis. Mine office: Parral, Chihuahua, Mexico. Employs 15 men. Wm. G. Gruber, president and general manager; Arthur H. Gruber, secretary and treasurer; preceding officers and Rev. Alois Plut, directors; Dr. Chas. Yetmar, vice-president; A. S. Mitchell, consulting engineer; Henry Bitsch, superintendent. Organized under laws of Wisconsin, with capitalization $250,000, shares $1 par, and is conducted as a close corporation.

Lands, 50 claims, in 3 groups, known as La Lolita, La Viola, and Santa Clara, located in the Galleano district of Chihuahua, in the San Blas mountains of the Sierra Madre range, 60 miles south of El Paso, midway between and 25 miles from the Mexican Central and Sierra Madre Pacifico railways. Principal development is on La Lolita group, which has shafts of 75′ and 150′, showing rich oxidized ores, assaying up to 70% copper, shipments from which have averaged 15% copper. In June, 1906, had 260 tons of high grade ore ready for shipment. Company plans installing a power plant.

SANTA RITA COPPER MINING & SMELTING CO. **ARIZONA.**

Disappeared from former office, 1609 Chemical Bldg., St. Louis, Mo. Organized June, 1901, under laws of Arizona, with capitalization $3,000,000, shares $1 par. Changed officers repeatedly, and was a mere stock-jobbing scheme. Lands claimed were in the Tindall district, Santa Rita Mountains, 38 miles south of Tucson, Arizona. Fully described in Volume V.

SANTA RITA MINING CO. **NEW MEXICO.**

Office: 85 Ames Bldg., Boston, Mass. Mine office: Santa Rita, Grant Co., N. M. Employs circa 100 men. Albert C. Burrage, president; B. B. Thayer, consulting engineer. Capitalization $5,000,000, shares $25 par. Is said to contemplate reduction of capitalization to $2,000,000. Paid a dividend of 50 cents per share, amounting to $100,000, in 1904.

Lands, 79 claims, 46 patented, area circa 640 acres, near Santa Rita. Is the oldest copper mine in New Mexico, and one of the oldest in the United States, having been opened A. D. 1800. The mine was abandoned, circa 1820, owing to the Mexican revolution, and was reopened, circa 1860. Development is by numerous shallow shafts, No. 8 shaft, with two compartments, is 214′ deep, and is carrying stopes on 8 drifts. No. 9, a 2-compartment shaft, started 1906, is to be sunk to 300′.

Equipment includes a 180-ton concentrator, supplied with rolls and Wilfley tables.

Company is exceedingly secretive, for reasons best known to the management, but is supposed to be closely allied with the Amalgamated Copper Co. Production was one carload of ore daily, at last accounts, and production, for 1905, is estimated at 2,000,000 lbs. fine copper, largely secured by leasers.

SANTA ROSA COPPER CO. **ARIZONA.**

Lands sold, circa 1905, to Detroit Copper Mining Co., of Arizona.

SANTA ROSA DEVELOPMENT CO. **MEXICO.**

Letter returned unclaimed from former office, Douglas, Ariz. Mine office: Santa Rosa, Sonora, Mex. Chas. A. Overlock, president; D. E. Heller, vice-president; Thos. A. Rendle, secretary and general manager. Organized September, 1903, under laws of Arizona, with capitalization $100,000, shares $10 par. Lands, 136 pertenencias, in the Arizpe district, about 15 miles south of Douglas and 3½ miles from the Nacozari railroad, showing three contact veins between porphyry and limestone, developed by 5 shafts and 5 tunnels. Ores carry good values in copper, lead and silver, with small gold values, assays having been secured up to 37% copper, 35% lead and 20 oz. silver per ton. Has a 25-h. p. gasoline hoist and 50-h. p. gasoline air-compressor. Idle.

SANTA ROSA DE MAZAPIL MINING CO. **MEXICO.**

Office: 20 Broad St., New York. Mine office: Mazapil, Zacatecas, Mex. Has gold, silver, lead and copper ores, developed by a 1,500′ tunnel and sundry shafts.

MINA SAN TELMO. **SPAIN.**

Owned and operated by Sociedad Colectiva Ibarra Hermanos.

MINA DE SANTIAGO. **MEXICO.**

Letter returned unclaimed from former mine office, El Fuerte, Sinaloa, Mexico.

SANTIAGO COPPER MINING CO. **CUBA.**

Succeeded, circa 1902, by El Cobre Mines.

SANTO DOMINGO MINING CO. **MEXICO.**

Office: care of W. B. Davis, president, Guadalajara, Mexico. W. M. Mathews, vice-president and general manager; Rufus P. March, secretary and treasurer; Austin G. Brady, comissario; Chas. H. Brooks, superintendent. Organized February 23, 1906, with capitalization $5,000,000, and is organized under laws of Mexico also, as Santo Domingo Mining Co., S. A.

Property is the Santo Domingo group, in the Hostotipaquillo district

of Jalisco, and the Iguana mine, in the Etzatlán district of Jalisco. The Santo Domingo group includes 11 properties, mainly antiguas, area 166 acres, said to show a large amount of ore blocked out. New development is by shaft and tunnel, said to show ore worth $35 to $40 per ton, to the value of $900,000, these figures presumably being in Mexican currency.

SANTO DOMINGO SYNDICATE. **SANTO DOMINGO & HAITI.**

Office: care of E. A. Blanton, Jr., general manager, The Bourse, Philadelphia, Pa. Mine office: San Cristobal, Santo Domingo. Capt. J. R. De Lamar, E. P. Earle, G. P. Lindermann, L. H. Taylor, Jr., W. T. White, Geo. R. Radford, T. C. Hall and E. T. Lavino, directors. Organized under laws of New Jersey, with capitalization $100,000. Lands, 100 square miles, in the republics of Haiti and Santo Domingo. The San Francisco Hills mine, near San Cristobal, Santo Domingo, is said by Mr. Blanton to show a body of chalcopyrite of 500′ width, carrying 5% to 20% copper, and $1 to $12.50 gold per ton. Early in 1906 a hoist and pumps were being installed, and in March, 1906, the company had about 1,000 men building a 42″ gauge railroad to the mine, which it was hoped to complete during the year.

SANTO NIÑO MINING CO. **MEXICO.**

Letters returned unclaimed from former office, Monterey, N. L., Mex., and former mine office, Symon, Dgo., Mex.

SAN TORINO MINES. **GREECE.**

Letter returned unclaimed from former mine office, San Torino, Greece. Is owned by an Austrian company, of Trieste. Ores are oxides and carbonates. Idle for several years.

SAN TOY MINING CO. **MEXICO.**

Office: 1314 Wells Bldg., Milwaukee, Wis. Mine office: Santa Eulalia, Chihuahua, Mexico. Sylvester T. Everett, president; Josiah Quincy, vice-president; A. S. Witherbee, secretary and treasurer; R. G. Morambert, manager. Organized under laws of Maine, with capitalization $2,500,000, shares $1 par. Control is said to have been bought, early in 1906, by residents of Pittsburg, who planned extensive work.

Lands, 5 groups of claims, on which considerable development has been secured, the old mine openings from a previous ownership aggregating nearly 10 miles length. Ore is low in grade, carrying mainly silver values, with a little copper only, with excess of iron Company claimed to have 200,000 tons of ore in sight, that would give returns of about $8 per ton, but probably both quantity and quality of ore were overestimated.

SAN XAVIER COPPER CO. **MEXICO.**

Office: care of Wm. Foster, secretary, Tucson, Ariz. Branch office: care of Max Muller, treasurer, Hermosillo, Sonora, Mexico. Mine office: San Xavier, Sonora, Mexico. C. C. Rountree, president; Gorge Grunig, vice-president. Organized under laws of Arizona, with capitalization $1,000,000, shares $1 par. Mexican incorporation is the Compañía Minera de Cerro Verde. Lands, 1,440 pertenencias, 80 miles east of La Colorada, also 300 pertenencias lying 24 miles to the southward, and circa 4 miles north of the Yaqui river.

SAPHO MINING CO. **NEVADA.**

Mine office: Ely White Pine Co., Nev. C. P. Webber, manager, at last accounts. Mine shows auriferous oxidized ores, assaying 6% to 22% copper, with paystreak running about $30 gold per ton. Has steam power.

SARATOGA PYRITIC SMELTING CO. **COLORADO.**

Office: 204 California Bldg., Denver, Colo. Mine office: Ironton, Ouray Co., Colo. Ores carry gold, silver, lead and copper. Has steam power.

SASAGATINI MINE. **JAPAN.**

Mine office: Hatazako-mura, Kanoashi-gori, Iwami, Japan. Has slightly argentiferous chalcopyrite, associated with sphalerite, galena and arsenopyrite, with quartz and limestone gangue, in numerous contact veins ranging up to 50′ in width. Production, 1900 was 62,961 momme silver and 274,412 lbs. fine copper.

SATER COPPER CO. **NEW MEXICO.**

Office: 1512 Farmers Bank Bldg., Pittsburg, Pa. Mine office: Kenton, Oklahoma. Chas. L. Medbury, president; Dr. W. W. Wolfe, vice-president; Geo. W. Charles, secretary and treasurer. Organized December 19, 1903, under laws of New Mexico, with capitalization $2,500,000, as a reorganization of the Copper Chief Mining Co., which came to grief, and was reorganized under present title, by Jared Sater, who was president of the Sater Copper Co., until ousted by shareholders, at the annual meeting, March, 1906.

Lands, 27 claims, area 540 acres, also a 5-acre millsite, in the Black Mesa district of Union county, New Mexico. Country rock is sandstone, said by company to show 7 fissure veins, of which 2, under development, are claimed to average 6′ width and to carry an average of 14% copper and 15 oz. silver per ton, in melaconite, malachite, azurite, bornite and chalcopyrite. Development is by shafts of 85′ and 225′, and by tunnels of 25′, 50′ and 300′, estimated by company to show 60,000 tons of ore, which is excessive. Has a 190-h. p. steam plant, and 2 hoists, with 4 mine buildings and an 18x70′ mill. Nearest railroad is 33 miles distant.

Jared Sater was dropped from the management at the last election, and promptly begun litigation, ending in the appointment of a receiver, circa April, 1906. Milton Sater accuses Jared Sater, and 5 other members of the Sater family, of all sorts of schemes and rascalities. Apparently the company was not born right, and can best serve the world by an early demise.

SAUK RIVER MINING CO. **WASHINGTON.**

Office: 327 Pacific Blk., Seattle, Wash. Mine office: Darrington, Snohomish Co., Wash. Harold G. Price, president and treasurer; Wm. Van Waters, secretary. Organized 1898, under laws of Washington, with capitalization $200,000, shares 50 cents par. Lands, 9 claims, area 180 acres, in three groups, carrying 3 veins of auriferous and argentiferous copper ore. Vein at Blue Bird group is claimed to be 98′ wide, between porphyry and slate, carrying 3 paystreaks, of 2′, 4′, and 6′, balance of vein being a low-grade self-fluxing concentrating ore. Idle at last accounts.

SAULT GRAY COPPER CO. **ONTARIO.**

Absorbed, circa 1903, by Copper Queen Mining Co., Ltd.

SAULT PROSPECTING & DEVELOPMENT CO. **ONTARIO.**

Succeeded, circa 1903 by Copper Queen Mining Co., Ltd

SAUX HEAD COPPER MINING CO., LTD. **MICHIGAN.**

Office: 36 Home Bank Bldg., Detroit, Mich. Mine office: Marquette, Marquette Co., Mich. Employs 8 men. Chas. A. Stringer, president and general manager; Frank M. Moore, vice-president; J. G. Krieg, secretary; Chas. M. Miller, treasurer; preceding officers and Geo. R. Purdon, directors; Frank E. Krieg, mine superintendent. Organized August 13, 1902, under laws of Michigan, with capitalization $2,500,000, shares $1 par; issued, $1,825,000.

Lands, 360 acres, owned in fee, in the Sauk's Head district, northwest of Marquette, 2 miles from the Lake Superior & Ishpeming railway, showing 2 ore bodies, said by company to occur as impregnations in granite and diorite, but stated by other authorities to be gash veins in granite, these ranging 4′ to 8′ in average width, giving assays of 1% to 4% copper and $2 to $200 gold per ton. Development is by shafts of 50′ and 170′, and by tunnels of 30′, 40′ and 70′. Has steam power with 2 donkey hoists, a 5-drill Ingersoll air-compressor and 4 power drills. Has 7 buildings, including a 15x20′ machine-shop, store, office and dwellings.

SAVAGE GOLD & COPPER CO. **ARIZONA.**

Offices: 625 Noble St., Chicago, Ills., and Douglas, Ariz. Mine office: Paradise, Cochise Co., Ariz. Employs 25 men, mainly Mexicans. F. M. Wajtalewicz, president; J. A. Lewandowski vice-president and general manager; C. R. Temple, secretary; A. P. Behnke, treasurer; Lewis Roberts, consulting engineer; Jas. Reay, superintendent. Organized January 6, 1904, under laws of Arizona, with capitalization $3,000,000, shares $1 par. Annual meeting, first Tuesday in November.

Lands, 43 claims, area 860 acres, in the California district, lying in the eastern foothills of the Chiricahua Mountains, next the San Simon valley, 10 miles from Rodeo, the nearest railroad station. Property shows 5 irregular ore bodies, apparently lenses, in contact zones between limestone and porphyry, of which 4, under development, are of 2′ to 36′ width, giving assays of 5% copper, 1% lead and from nothing to 30 oz. silver per ton, lead values being from occasional galena. Development is by shafts of 50′, 65′, 100′, 65′ and 40′, and by a 400′ tunnel, with a total of 1,355′ of workings.

Equipment includes necessary mine buildings and is to include a smelter with a 50-ton cylindrical water-jacket blast-furnace. This was to have been blown in, May, 1905, but in April, 1906, the furnace had not been erected, though the material was on the ground.

SAVAGE GOLD & COPPER MINING CO. **COLORADO, NEW MEXICO & WYOMING.**

Office: Cripple Creek, Colo. Capitalization $1,500,000, shares $1 par. Lands, 4 fractional gold claims, area 12 acres, in the Cripple Creek district, Teller county, Colorado; sundry claims in the Santa Rita district, Grant county, New Mexico, and claims in the Battle Lake district, Carbon county, Wyoming. The Cripple Creek property is under lease to T. H. Thomas,

and the copper properties, in New Mexico and Wyoming, latter considered well located, are idle, as management prefers waiting to going in debt.

SAVANIC MINE. **ARIZONA.**

Office: care of Col. H. L. Pickett, St. George, Utah. A partly developed mine, in the northern part of Mohave county, Arizona, nearest town being St. George. Shipped 14 carloads of copper ore to Salt Lake smelters, averaging 39% copper, this being hauled 140 miles by wagon and 300 miles by rail. Erection of small smelter, on the banks of Virgin river, has been tentatively considered. Property is promising, but is almost inaccessible, at present.

SAWATARI MINE. **JAPAN.**

Owned by Mitsu Bishi Goshi-Kwaisha.

SAYLER MINE. **CALIFORNIA.**

Letter returned unclaimed from former mine office, Garlock, Cal.

SCANLAN MINE. **ARIZONA.**

Office and mine: care of L. H. Scanlan, owner, Paradise, Cochise Co., Ariz. Lands, 12 claims, opened by a 125′ incline shaft, said to be bottomed in a 30′ vein of chalcopyrite, and by a tunnel, 175′ long at end of 1905, planned to cut the ore body at a distance 400′, giving a back of 325′.

SCANTIC GOLD MINING & MILLING CO. **COLORADO & MEXICO.**

Office: 206 Continental Bldg., St. Louis, Mo. Mine offices: White Cross, Hinsdale Co., Colo., and Charcas, San Luis Potosí, Mex. John H. Hammond, Denver, president and general manager; W. F. Smith, superintendent of Colorado property, which has steam power, and is developing ores of gold, silver, copper and lead. Joseph T. Murphy, manager of Mexican property, which includes the San Sebastian and extensions, carrying silver, lead and copper, equipped with a 25-ton concentrator, employing circa 100 men, at last accounts.

KUPFERKIESBERGBAU SCHATTBERG. **AUSTRIA.**

Mine office: Schattberg, Tyrol, Austria. Is a very small producer.

GEWERKSCHAFT SCHLESISCHE NICKELWERKE. **GERMANY.**

Mine office: Gläsendorf, Schlesien, Germany. Lucien Pierron, president; W. Woltman, smelter superintendent. Lands include 7 properties developed by shallow shafts. Employed circa 300 men, and produced 60 tons daily of cupriferous nickel ore, at last accounts.

SCHUYLKILL COPPER CO. **ARIZONA.**

Letter returned unclaimed from former mine office, Chloride. Ariz.

SCOTIA MINING & MILLING CO. **WASHINGTON.**

Office: Spokane, Wash. Letter returned unclaimed from former mine office, Bossburg, Stevens Co., Wash. Ores carry gold, silver and copper.

SCOTTISH-AUSTRALIAN COPPER CORPORATION, LTD.

Organized Jan. 14, 1904, under laws of Guernsey, with capitalization £200,000, shares £1 par.

SCOTTISH-AUSTRALIAN MINING CO., LTD. **AUSTRALIA.**

Offices: Winchester House, London, E. C., Eng. G. T. Rait, chairman; H. F. Chilcott, mine manager; F. W. Turner, secretary. Organized Jan. 6, 1859, with capitalization £250,000, shares £1 par. Is an old and successful

Underhill, Jr., secretary; Alfred von der Ropp, superintendent; John Chase, purchasing agent. Organized 1875, under laws of California. Control of stock was secured, 1905, by American Smelters Securities Co.

The company has an extensive smelting and refining plant, equipped with steam and electric power, at Vallejo Junction, near Carquinez Strait, the site of the smelter being somewhat circumscribed. Ore is received by rail and water, the works drawing ore supplies from all of the Pacific states. The smelter has 4 blast-furnaces, including both lead lead and copper stacks, and also operates a lead refinery and a plant for parting gold and silver, and incidentally manufactures copper sulphate. Fuel is coal, coke and petroleum.

SELKIRK MOTHER-LODE COPPER MINES, LTD. BRITISH COLUMBIA.

Letter returned unclaimed from former office, London, Eng.

SEMINOLE COPPER MINING CO. GEORGIA.

Dead. Property sold, 1904, by the sheriff, to Carl Henrich, for $33,000.

SEMINOLE MINE. GEORGIA.

Office and mine: care of Carl Henrich, owner, Metasville, Wilkes Co., Ga Employs 18 men. Property, held formerly by Seminole Copper Mining Co., was sold at sheriff's sale, July, 1904, to Mr. Henrich, for $33,000.

Lands, 901 acres, freehold, including the Magruder mine, well timbered with pine, cedar, and hardwood, in Lincoln county, Georgia, 12 miles from the Georgia Central railroad. Country rock is pre-Cambrian schist, intruded by eruptive dikes of two different ages, carrying numerous fissures in schists and contact veins between schist and eruptive rocks, ore bodies occurring in four nearly parallel veins, with other unexplored ore bodies existing and with 5 ore bodies under development. Openings include shafts of 90′, 150′ and 245′, with a total of 1,500′ of workings, estimated to have blocked out 1,000 tons of ore for stoping, in veins of 2′ to 12′ width, carrying chalcopyrite and galena, with estimated average values of 3% to 4% copper, 5% to 12% lead, 2.5% zinc, 5.5 oz. silver and $3 gold per ton. The old main shaft was badly caved in, but has been reopened, retimbered and new pumps installed. The property was opened circa 1852, closed 1862, on account of the American Civil War, and was reopened in 1878, 1899, and 1905.

Mining equipment includes 12-h. p. and 15-h. p. hoists, good for 500′ each, and a 4-drill Rand air-compressor. Buildings include a 20x30′ smithy a small machine shop and a small concentrator and smelter. The concentrator, 30x65′, of wood, has 1 Gates crusher, 1 set of rolls, 1 Twentieth Century jig and 2 Bartlett tables. The smelter has a small reverberatory furnace and a 15-ton rectangular water-jacket blast-furnace, making matte of 15% to 45% copper tenor.

A tram-line connects the mine and concentrator. The machinery plant has been overhauled, and worn-out parts replaced. Production, 1905, was only 8,800 lbs. fine copper, from 125 tons of ore treated, but the owner estimates 1906 production at 30,000 to 60,000 lbs. fine copper monthly. Cost of mining is $2.50 to $3.50 per ton, and cost of concentration is 70 cents per ton. Management is good, and property is considered promising.

SENECA MINING CO. **MICHIGAN.**

Office: 301–199 Washington St., Boston, Mass. Operating office: Houghton, Houghton, Co. Mich Albert S. Bigelow, president; William J. Ladd, secretary and treasurer; Norman W. Haire, general manager. Organized under laws of Michigan, with capitalization $500,000, shares $25 par. Lands, 1,880 acres, lying just north of the Mohawk and Ahmeek mines, in Keweenaw county, Michigan, the Ahmeek having been set off from the Seneca, in 1880. Two shafts were sunk, to a depth of circa 200′ each, about 1880, since when no mining has been attempted. Developments to the east and south render it certain that the Kearsarge amygdaloid must underlie a considerable portion of the tract, the Seneca carrying the underlay of the Mohawk. Recent developments in the Mohawk mine are more promising, and indicate that the Seneca should carry good values in the Kearsarge lode.

In addition to the Kearsarge bed, the Seneca tract carries the extensions of the Calumet, Kearsarge and Allouez conglomerates, and the Osceola amygdaloid. The Kearsarge amygdaloid outcrops on the northeastern corner of the tract. The property is one of much promise, and doubtless will be developed in the future.

SOCIEDAD MINERA SERENA. **CHILE.**

Mine office: La Serena, Coquimbo, Chile Has steam power and employed circa 100 men, at last accounts.

SERRANO GOLD & COPPER MINING CO. **MEXICO.**

Office: Main St., Danville, Pa. Mine office: care of T. H. Collins, general manager, La Cananea, Sonora, Mex. J. X. Grier, president; C. E. Yorks, secretary; M. I. Low, treasurer. Organized February, 1903, under laws of Arizona, with capitalization $2,000,000, shares $1 par. Lands, 112 pertenencias, south of Cananea, carrying auriferous copper ores.

SERRAZANO COPPER CO., LTD. **ITALY.**

Organized March 28, 1903, under laws of Guernsey, with capitalization £80,000, shares £4 par, to acquire copper mines at Serrazano, Italy.

SEVEN DEVILS MINING & DEVELOPMENT CO. **IDAHO.**

Letter returned unclaimed from former office, 63 Devonshire St., Boston, Mass.

SEVILLE SULPHUR & COPPER CO., LTD. **SPAIN.**

Offices: 30, George Square, Glasgow, Scotland. Spanish general offices: Patio de Banderas, Sevilla, Spain. Mine office: Aznalcóllar, Sevilla, Spain. Jas. Pipe, chairman; John Munro, secretary; John L. Macdougall, general manager; Robert Andrew, engineer; Capitalization £120,000, shares £10 par. Property, at the eastern end of the Sierra Morena, in the province of Sevilla, carries rich cupriferous iron pyrites, of good sulphur tenor, worked for years, by present company, with signal success. Production, 1905 was 2,867,200 lbs. fine copper.

SEYMOUR COPPER MINING CO., LTD. **BRITISH COLUMBIA.**

Offices: 41, John Dalton St., Manchester, Eng. H. J. Challoner, secretary. Organized June 25, 1900, with capitalization £2,000, shares 5s. par, to ac-

quire copper properties at Seymour Narrows, Vancouver Island, British Columbia. Apparently moribund.

SHAFTER MINING CO. **COLORADO.**

Mine office: Idaho Springs, Clear Creek Co., Colo. Arthur H. Roller, superintendent, at last accounts. Ores carry gold, silver and copper. Has steam and electric power.

SHAMBLÜRGSKI WORKS. **RUSSIA.**

Office: care of A. A. Broli, owner, Tifiis, Russia. Property includes sundry copper mines and a small smelter, in the Russian Caucasus.

SHANNON COPPER CO. **ARIZONA.**

Office: 52 Broadway, New York. Mine office: Clifton, Graham Co., Ariz. Employs circa 500 men, largely Mexican labor. W. J. Palmer, president; Berthold Hochschild, vice-president; Meredith Hare, secretary; J. W. Hazen, treasurer; preceding officers, Chas. F. Brooker, A. A. Cowles, Dr. Leonard Wheeler and James Virden, directors; J. W. Bennie, general manager; H. H. Dyer, mine superintendent; Rollo B. Watson, engineer.

Organized Nov. 13, 1899, under laws of Delaware, with capitalization $3,000,000, shares $10 par. Bonds, $420,000 outstanding, at 7%, being balance of $600,000 issued, of which $180,000 have been retired, in 3 annual installments of $60,000, for which purpose of redemption the company places $60,000 yearly in a sinking fund. Controls the Coronado Mining Co., through ownership of 51% of stock issue, and has leased the property of the Coronado for 4 years, until Oct. 8, 1908. Boston Safe Deposit & Trust Co., transfer agent; National Shawmut Bank Boston, registrar. Has circa 1,300 shareholders.

Lands, 43 claims, area 400 acres, at Metcalf, in the Greenlee district, also 400 acres in mill and smelter sites. The Shannon has a side-line agreement with the Arizona Copper Co., by which extra-lateral rights are mutually waived, and all possibility of future litigation removed. Ore occurs as very irregular bodies, between limestone and porphyry, these having heavy gossan cappings of fairly good hematite, the oxidized ores favoring the limestone, while ore deposits of the porphyry side are mainly silicious sulphides, latter predominating. The mine shows oxide and carbonate ores of 4% to 10% tenor in the upper levels, and sulphide ores of 3% to 7% copper tenor in the lower workings, sulphide ores being mainly chalcopyrite, with a little chalcocite. The mine is opened by shafts and tunnels, to a depth of 1,100′ from the crest of the mountain, mine openings being timbered with 12x12″ square sets. The mine has circa 8 miles of underground workings, with considerable ore reserves. There is some question as to whether ore values are holding at depth. The Little Coronado mine shows 3% to 5% copper. The Hanson tunnel is said to show an ore body of 180′ width, averaging 6% copper. Open-cuts show iron ore carrying 2.5% copper, valuable for fluxing the silicious sulphides produced by the principal workings of the mine. The mine has two double-track working tunnels, of which one, 7x8′ in size and 715′ long, is connected with a 1,400′ double-track incline tram leading to the Coronado railroad, with 6 ore-bins at either end, the tramway having an inclination of 36°. The incline has 10-ton cars, oper-

ated in counterbalance, with a retarding engine, the steel cable passing around a 13′ double drum at the top, which, in addition to lowering the loaded and raising the empty cars, runs a small air-compressor that generates power, while serving as an auxiliary brake.

The company operates general stores at Morenci and Clifton, and owns a number of dwellings, for employes. Petroleum has been substituted for coal, wherever possible, about the mine and works.

The concentrator, on the San Francisco river, 8 miles from the mine, is of steel, in two connected sections, the 64x95′ upper section having a 9x15″ Blake crusher at the ore-bin, Huntington mills and a 220′ Robins belt conveyer, trommels and jigs. The 57x144′ lower section has 33 Frue vanners, 1 Wilfley and 2 Standard tables. The 32x50′ steel power-house has two 250-h. p. Stirling water-tube boilers, and a 300-h. p. Nordberg tandem compound engine. Water is taken from wells near the river by a 600-gallon electric triplex pump. The concentrator treats about 400 tons of ore daily, this averaging 3.5% to 5.5% copper, and puts about 5 into 1, effecting a saving of about 75% of contained values. Formerly there was much trouble from the acid waters eating the iron screens, while brass or copper screens in the jigs were worn out too rapidly, by abrasion. This trouble has been overcome by a simple but highly ingenious application of the principle of electrolysis. A low-voltage electric current has been applied to the jigs, by which the screen becomes a cathode in the circuit. This attracts hydrogen from the water, which in turn attacks the metallic salts, and the copper freed is deposited on that portion of the screens formerly eaten away. Formerly, iron screens lasted only two to three days, and brass or copper screens had a life of but 30 days at most. The credit for this device is due to Mr. Bennie.

The smelter, at Clifton, 7 miles from the mines, is designed for five furnaces, and has two 350-ton water-jacket blast-furnaces, 42x170″ each at the tuyeres. Above the charging floor are 23 ore-bins, each 20x20x16′, with chutes. A 10′ dust-flue leads to a 20x20x100′ dust-chamber, with hopper-bottom, discharging periodically into cars on a railroad track, in the tunnel beneath. The fumes pass from this dust-chamber through a 170′ flue to a 150′ steel smokestack. A 60x80′ power-house, of steel, on stone foundations, houses a 300-h. p. tandem compound condensing engine, direct-connected to blowers with capacity of 3,000 cubic feet of free air per minute. The smelter has a slag-line, with electric locomotive. A newly added converter plant, with two stands and a 250-h. p. Nordberg air-compressor, was started up March, 1906, and is said to be saving the company about ½ cent per pound, on the output of fine copper. The blister copper produced is sold to the American Metal Co., Ltd., under a 3-year contract, expiring May 14, 1908. The briquetting plant for flue-dust and fines has a daily capacity of 60 tons, and a sampling mill is being built, in 1906. Slag losses are said to be only 0.515%, and not 1.5% copper, as reported.

Production. 1904. was 11,899,920 lbs. fine copper, and for the calendar year 1905, was 11,027,453 lbs. fine copper. In the fiscal year 1905, production was 11,295,568 lbs. fine copper. 17,127 oz. fine silver and 592 oz. fine

gold. Ore production, for fiscal year 1905, was 188,856 tons, of which the smelting ore averaged 5.15% copper, furnishing 28% of the total production, while the milling ore averaged 3.66% copper. The percentage of copper secured apparently is declining. Cost of copper, for fiscal year 1905, was 12.11 cents per pound, an increase of about one cent, and profits were $271,150. Underground mining conditions are said to be improving. The complaints about the smelter, several years ago, were an injustice to its designer, Mr. Paul O. Wels, as the trouble was with the mine, as has been proven by the outcome. There has been entirely too much market manipulation of Shannon stock, in the past, and it is to be hoped that this is nearly at an end. The property is well equipped, and, though low in grade, should be able to earn fair profits.

SHASTA COPPER MINING CO. **CALIFORNIA.**

Letter returned unclaimed from former mine office, Shasta, Cal.

SHASTA GOLD & COPPER CO. **CALIFORNIA.**

Office: 326 Post St., San Francisco, Cal. W. F. Mitchell, president and general manager; W. E. von Johannsen, secretary. Capitalization $500,000, shares $1 par. Lands, 14 claims, in the Dog Creek district, about 12 miles north of Redding, Shasta county, California, claimed to show 3 gold-bearing quartz veins and 2 copper veins. Company is regarded with much suspicion, owing to its connection with "Baron" von Johannsen, who is an unmitigated scoundrel.

SHASTA MAY BLOSSOM COPPER CO., CONSOLIDATED. **CALIFORNIA.**

Office: 36 Nevada Blk., San Francisco, Cal. Mine office: Winthrop, Shasta Co., Cal. Morton Lindley, president; Lucius A. Booth, vice-president; S. Peter, secretary and treasurer; Sumner S. Smith, superintendent. Organized 1903, under laws of Arizona, with capitalization $10,000,000, shares $1 par, as a reconstruction of the Shasta May Blossom Mining & Smelting Co.

Lands, 18 claims, area 300 acres, in the Pittsburg or Copper City district, circa 27 miles northeast of Redding, lands being only 800′ from the holdings of the Bully Hill mine. Property shows 5 or more contact veins, having granite-porphyry footwalls and slate hangings, with good gossan outcrops. Of the 3 veins more or less developed, the Middle vein ranges 5′ to 40′ in width, and is traceable for 9,000′, carrying chalcocite, bornite and chalcopyrite, opened by tunnels of 200′, 350′ and 450′, with a total of circa 1,500′ of workings. Equipment includes an air-compressor, 20x90′ machine shop and two other mine buildings. Property is 16 miles from Terry, the nearest railroad point.

SHASTA MAY BLOSSOM MINING & SMELTING CO. **CALIFORNIA.**

Reorganized, 1903, as Shasta May Blossom Copper Co., Consolidated.

SHATTUCK-ARIZONA COPPER CO. **ARIZONA.**

Office: Duluth, Minn. Mine office: Bisbee, Cochise Co., Ariz. Employs 100 men. Thos. Bardon, president; Archibald Mark Chisholm, secretary and treasurer; A. Guthrie, vice-president; preceding officers, Martin Pattison and Lemuel C. Shattuck, directors; Byron Pattison, superintendent. Organized April, 1904, under laws of Minnesota, with capitalization $3,500,000, shares

$10 par; issued, $2,500,000. Annual meeting, third Saturday in February.

Lands, 6 claims, area 120 acres, patented and fully paid for, in the Warren district, lying in the northeast portion of the Bisbee camp, about one mile from the older workings of the Copper Queen, and north of the Calumet & Arizona. Country rock is Carboniferous limestone, with intrusive porphyry dikes, showing a silicious iron capping of 30′ to 50′ width, on a big fault. Owing to the rugged topography of the lands, tunneling is impracticable, neighboring properties holding all available tunnel-sites, hence development is by a shaft of 800′, with circa 3,000′ of underground workings. The shaft has been cut down to 3 compartments, 4′6″x15′ in size, and the mine is to be connected underground with the Cuprite shaft of the Copper Queen. Ore occurs in irregular deposits, as in the other mines of the district, ores including all the common oxides, carbonates and sulphides, and carrying an average of 9% copper.

Development was begun by the present company August, 1904, and has been continued with great vigor. Equipment includes a 400-h. p. steam plant, with 6x10″ and 10x30″ hoists, good for 1,000′ depth, and the mine is to have a new Allis-Chalmers duplex double-drum hoist, working under 125 pounds steam pressure, capable of handling continuously a total unbalanced load of 15,000 lbs., at a vertical hoisting speed of 2,000′ per minute. The hoist will have two 7′ drums, each carrying 1,500′ of 1⅛″ round steel cable. Equipment includes a Sullivan 6-drill straight-line air-compressor and 9 Ingersoll-Sergeant power drills, and a 25-drill air-compressor and 500-light electric plant are to be added. Buildings include a 16x24′ carpenter shop, 15x30′ smithy, boiler-house, engine-house, office, warehouse, etc. The El Paso & Southwestern railroad reaches within 3,000′ of the shaft, and the company plans building a 1,000-ton aerial tramway, to be in operation before close of 1906. The tramway will have an average grade of 18%, leading to a 200-ton ore bin, now building, and probably will have a retarding engine. Fuel is petroleum, with a yearly consumption of 2,500 barrels. The company plans continuing development, and blocking out ore on the 700′ and 800′ levels. From about 1,000 tons of oxide and carbonate ores smelted, during the first half of 1906, average returns were 9% copper, ores having been shipped without assortment. The management plans beginning production on a considerable scale, before the end of 1906, by shipments to the Copper Queen smelter, and may build a smelter later, which probably will be located at Douglas, if built. Company estimates the probable production of 1906 at 4,000,000 lbs. fine copper, but very likely will fall somewhat short, owing to delay in beginning production, but should be a considerable producer in 1907. The Shattuck has been well handled, and very quickly developed, and bids fair to make an exceptionally fine mine.

SHAW-GIBSON MINING CO. **NEW MEXICO.**

Letter returned unclaimed from former mine office, Lordsburg, N. M.

SHAWMUT CONSOLIDATED COPPER CO. **COLORADO & UTAH.**

Office: 62-16 State St., Boston Mass. Mine offices: Bingham Canyon, Salt Lake Co., Utah, and Salida, Chaffee Co., Colo. Lester C. Wead, presi-

dent; Wm Rotch, vice-president; Robt. A. Jackson, secretary and treasurer; Herbert Williams, managing director; preceding officers, Alex. Chandler B. W. Currier, Col. E. J. Mayo, Hon. Saml. S. Powers and John R. Thayer, directors; Elmer Durfee, superintendent Utah mine; E. Philbrick, superintendent Colorado mine. Organized 1905, under laws of Maine, with capitalization $2,500,000, shares $25 par; issued, $1,225,000. American Loan & Trust Co., Boston, registrar; State Street Trust Co., Boston, transfer agent. Has an option on 65,000 shares of the Sedalia Copper Co., held in escrow until May, 1909, at $2 per share. The Shawmut pays 15% royalty on extraction from the Salida property, such royalty to apply pro rata on the purchase price of the stock in escrow, if same is taken.

The Utah lands include 13 fractional claims, patented, area 152 acres, on the north side of Carr Fork, almost in the center of the Bingham, or West Mountain district, showing country rocks of limestone, porphyry and quartzite, carrying sundry contact veins, between limestone and quartzite, of which two, under development, are of 5′ estimated average width, carrying sulphide ores, mainly argentiferous and auriferous chalcopyrite and galena, containing estimated average values of 5% copper, 26% lead, 2 oz. to 16 oz. silver and $2.50 to $5 gold per ton. Development is by a 230′ shaft and 8 tunnels, with upwards of 7,000′ of workings. Property was idle for some years, on account of litigation and poor management. On the Cuba claim, 2 upper levels have been developed, and a lower tunnel is driving, a vein of 5′ average width outcropping for the length of this claim. The management hopes to secure copper-bearing porphyry, similar to that of adjoining properties, on the Mirror claim. Equipment includes a 200-h. p. steam plant, at the mine, including a 6-drill Rand air-compressor, with necessary mine buildings.

The concentrator at the Bingham property is of 100 tons daily capacity, built of wood, and equipped with a 100-ton Gates centrifugal crusher, 2 sets of rolls, 5 Hartz jigs, a Chilean mill and Wilfley tables. The mill is somewhat antiquated, and requires remodeling. The property is served by the Denver & Rio Grande railroad.

The Salida property, known as the Sedalia mine, includes 20 acres and a millsite, the mine and mill being connected by a tramway of circa 1½ miles length. The mine has a very large body of very low-grade ore, and produces 750 to 1,200 tons per month. The mill is a four-story 76x119′ concentrator and leaching plant. The management of the Shawmut company states that recent improvements have reduced operating expenses so that a good profit is being made on 3% copper ore. The management of the company was changed, June, 1906. Properties are considered promising.

SHAWMUT MINING CO. **UTAH.**

Succeeded, 1905, by Shawmut Consolidated Copper Co.

SHAWNEE COPPER MINING CO. **WYOMING.**

Office: 122½ East Main St., Shawnee, Okla. Mine office: Encampment, Carbon Co., Wyo. Employs 10 men. J. H. Ware, president; B. F. Hamilton, vice-president; A. M. Coffin, secretary; John H. Aydelotte, treas-

urer; preceding officers and Frank E. Fagerquist, directors; A. H. Crow, superintendent. Organized September 20, 1905, under laws of Oklahoma, with capitalization $1,000,000, shares, $1 par; issued, $630,000. Annual meeting, first Thursday in October.

Lands, 10 claims, area 200 acres, well timbered, lying in the French district, on Iron Creek, near the New Rambler mine, showing sundry fissure veins in granite, and contact veins between schist and quartzite, of which one vein, of bog ore, under development by a 115′ two-compartment shaft, is showing copper stains only. Equipment includes a 45-h. p. steam plant, and four buildings, of logs.

SHEEP MOUNTAIN MINING & TUNNEL CO. **COLORADO.**

Letters returned unclaimed from former mine office, Crystal, Colo.

SHELDEN & COLUMBIAN MINE. **MICHIGAN.**

Office and mine: care of J. H. Rice, Houghton, Houghton Co., Mich. Lands lie next north of the Isle Royale Copper Co. Idle since 1870. Fully described in Vols. I and II.

SHOSHONE MINE. **NEW MEXICO.**

Office and mine: care of Alex Gusdorf, owner, Taos, Taos Co., N. M. Lands, 4 claims, developed by a 175′ shaft, with several hundred feet of drifts on the 100′ and 150′ levels, showing an 8′ vein with a 2′ paystreak, latter carrying 5% copper, 10 oz. to 12 oz. silver and 3 oz. to 4 oz. gold per ton, balance of vein averaging 5% to 8% copper, 4 oz. to 5 oz. silver and $10 to $12 gold per ton. Property is considered promising.

SHOSHONE MOUNTAIN MINING CO. **WYOMING.**

Mine office: Meeteetse, Big Horn Co., Wyo. P. W. Gates, manager. Lands, sundry claims, on Sparr Mountain, showing a wide vein, carrying values mainly in silver-lead, opened by a 560′ tunnel, on the Smuggler claim.

SHOTWELL TRI-MOUNTAIN COPPER CO. **ARIZONA.**

Office: 323 Security Bldg., St. Louis, Mo. Mine office: Ajo, Pima Co., Ariz. Organized under laws of Arizona, and is supposed to own the Shotwell mine, a rather promising property, slightly developed, but circa 68 miles from rail connections.

SHRIVER MINE. **TEXAS.**

An old mine, with a 385′ shaft, idle some years, near Llano, Llano county, Texas.

SHUTTLETON MINE. **AUSTRALIA.**

Mine office: Shuttleton, N. S. W., Australia. Property, in the Crowl Creek district, is opened to a depth of 330′, the bottom level showing a 12′ vein, with 4′ paystreak of chalcopyrite, assaying 22% copper. Presumably idle.

SIEGEL CONSOLIDATED MINING CO. **NEVADA.**

Mine office: Siegelton, White Pine Co., Nev. Presumably successor to the Vulcan Consolidated Co., of which Henry Siegel, the New York department-store merchant, was president, and which went out of business quietly, without paying its debts. Lands, 49 claims, area 980 acres, also 3 millsites, in the Sodaville or Santa Fé district, developed, 1903, by circa

7,000′ of underground openings, claimed to show circa 60,000 tons of ore, assaying 2.7% to 4% copper, with 75 cents to $1 gold and silver per ton. Property has a small and inadequate smelter.

SIERRA-ALTO COPPER MINING CO. **ARIZONA.**

Letter returned unclaimed from former office, 60 State St., Boston, Mass.

MINAS DE SIERRACILLA DEL TAMUJOSO. **SPAIN.**

Office: care of Wm. Guthrie Bowie, manager, Alosno, Huelva, Spain. Mine office: Puebla de Guzmán, Huelva, Spain. C. & J. Sundheim, owners. Some shipments were made by former operators, but ore is complex and requires special treatment. Idle for several years

SIERRA COMPANY, LTD. **SPAIN.**

Offices: 32, Nicholas Lane, London, E. C., Eng. Mine office: 10, Plaza del General Santacildes, Burgos, Burgos, Spain. T. Evens, secretary. Organized April 2, 1898, with capitalization £400,000, shares £10 par; debentures, £478,100, at 5%. Lands, sundry mines, carrying iron, copper, silver and coal, in the provinces of Burgos and Logroño, Spain.

SIERRA DE COBRE MINE. **MEXICO.**

Described under title Indiana-Sonora Copper & Mining Co.

SIERRA DE ORO GOLD MINING & MILLING CO. **ARIZONA.**

Office and mine: Clifton, Graham Co., Ariz. F. T. Eldredge, president; W. H. Waite, secretary and treasurer; L. P Potter, manager; Benj. M. Crawford, superintendent. Lands, 15 claims, near the Clifton Consolidated, also a 5-acre millsite, on the San Francisco river. Development is by tunnels, showing 4 parallel blind veins. A 550′ crosscut tunnel shows a 10′ vein, giving assay values of 14% copper and up to $10 gold per ton, and a 4′ vein giving assays of 14% copper and $48 gold per ton. Property is well regarded.

SIERRA MADRE EXPLORATION, LTD. **MEXICO**

Offices: 708, Salisbury House, London, E. C., Eng. J. K. Pollock chairman; J. W. Gallienne, secretary. Organized Nov. 21, 1900, with capitalization £60,000, shares 5s. par; issued, £40,000. Debentures, £1,000 authorized, £900 outstanding. Had options on gold and silver properties in the state of Chihuahua, Mexico, which were forfeited. Present landed holdings are 200 pertenencias, area 494 acres, in the state of Sonora, supposedly carrying auriferous and argentiferous copper ores.

SIERRA MORENA COPPER MINES, LTD. **SPAIN.**

Offices: 2, Basinghall Ave., London, E. C., Eng. Letter returned unclaimed from former mine office, Peñaflor, Sevilla, Spain. R. Stanton, mine manager; J E. G. Hadath, secretary. Organized April 17, 1900, with capitalization £80,000, shares £1 par; issued, £60,007. Lands were 12 hectareas, including La Preciosa and adjoining mines.

MINAS DE SIERRA NEVADA. **SPAIN.**

Mine office: Guejar Sierra, Granada, Spain. Supposedly owned by a Belgian company. Have argentiferous copper ores. Idle.

SIERRA PACIFIC SMELTING CO. **MONTANA & MEXICO.**

Disappeared, 1906, from former offices, in Minneapolis.

SIERRA-SONORA SMELTING CO. **MEXICO.**

Title changed, 1903, to Sierra-Pacific Smelting Co.

SIERRITA MINING & MILLING CO. **ARIZONA.**

Office: care of J. P. Owen, general manager, Tucson, Ariz.

SIGNAL COPPER CO. **ARIZONA.**

Office: care of Col. H. G. Heffron, president, Kingman, Ariz. Lands, sundry claims, including the Copper Prince group, on the Bill Williams Fork river, near the line of the Arizona & California railroad, in Yuma county, Arizona. The Copper Prince has a 150′ shaft, showing a very large body of copper ore. Ample water is available, from the river. Property is said to have been sold, March, 1906, to O. P. Posey, and others. Property is regarded as promising.

SIGNET GOLD & COPPER MINING CO. **UTAH.**

Office: care of E. E. George, secretary, Salt Lake City, Utah. Letter returned unclaimed from former mine office, American Fork, Utah Co., Utah. C. E. Stewart, president; A. W. Lister, treasurer; Organized November, 1903, under laws of Utah, with capitalization $75,000, shares 25c. par. Property is the Signet group, 4 claims, on which a little work has been done. Idle.

SILERS MEADOWS COPPER CO. **NORTH CAROLINA.**

Mine office: Bushnell, Swain Co., N. C. Lands, circa 1,900 acres, in the Smoky Mountains, on the Tennessee copper belt. Has 11 shafts and tunnels, all showing ore, said to give average assays of 5.5% copper and $1.80 silver and gold per ton. Property regarded as promising, but presumably idle.

SILVER BAR COPPER MINING CO. **NEW MEXICO.**

Dead. Property sold, circa 1902, to Mogollon Gold & Copper Co.

SILVER BELL COPPER CO. **ARIZONA.**

Title changed, 1903, to Imperial Copper Co.

SILVER BOW MINE. **MONTANA.**

Owned by Butte & Boston Consolidated Mining Co.

SILVER CITY REDUCTION WORKS. **NEW MEXICO.**

Owned by Comanche Mining & Smelting Co.

SILVER CLIFF GOLD & COPPER MINING CO. **MONTANA.**

Letters returned unclaimed from former mine office, Saltese, Missoula Co., Montana, and various other points.

SILVER CLIFF MINING CO. **IDAHO.**

Mine office: Lookout, Nez Perce Co., Idaho. Jas. D. Young, manager. Ore body carries an 18″ paystreak, giving assay values up to 70% copper and $200 gold per ton.

SILVER CONNOR MINE. **NEVADA.**

Mine office: Eureka, Eureka Co., Nev. Said to have blocked out circa 50,000 tons of low-grade ore, averaging about $6 in gold and silver, and shipped a little high-grade ore, averaging 27.9% copper, to a Salt Lake smelter, in 1903.

SILVER CREEK GOLD MINING CO. **WASHINGTON.**

Office: Everett, Wash. Letter returned unclaimed from former office, Index, Snohomish Co., Wash. A. J. Westland, president; W. B. E. Edwards, secretary. Capitalization $1,000,000, shares $1 par. Lands, 6 claims, circa 10 miles from Index, opened by about 500′ of tunnels, said to show a vein of fair size, carrying small copper values and fair gold and silver values.

SILVER FLAT MINING & MILLING CO. **UTAH.**

Office: care of Abel John Evans, Lehi, Utah. Mine office: American Fork, Utah Co., Utah. Capitalization $50,000, shares 10 cents par. Lands, 5 claims, in the Silver Lake district, carrying auriferous and argentiferous copper and lead ores.

SILVER GLANCE GROUP. **NEW MEXICO.**

Office and mine: care of Joseph Oliver, owner, Chloride, Sierra Co., N. M. Lands, 6 claims, area 120 acres, also a millsite, in the Apache district, showing 7 fissure veins, averaging 4′ width, opened by shafts of 60′, 100′, and 110′ and tunnels of 120′ and 125′, showing sulphide ores, giving assays of 10% copper, 30 oz. silver and $10 gold per ton.

SILVER HILL MINING CO. **NORTH CAROLINA.**

Mine office: Silver Hill, Davidson Co., N. C. J. M. Prim, superintendent, at last accounts. Ores carry gold, silver, lead, copper and zinc. Has steam power and a mill with 5 stamps, crusher and rolls.

SILVER KING MINING CO. **UTAH.**

Mine office: Park City, Summit Co., Utah. Hon. Thos. Kearns, general manager; W. J. Dalley, superintendent. Ores carry gold, silver, lead and copper. Has steam power and a 250-ton concentrator, employing circa 300 men. Is a famous silver mine, and secures a little copper as a by-product.

SILVER LAKE MINES. **COLORADO.**

Owned by Guggenheim Exploration Co.

SILVERMAN-ALASKA MINING CO. **ALASKA.**

Office: 11 Broadway, New York. Mine office: Ketchikan, Alaska. Supposedly organized under laws of New Jersey. Lands, on Prince of Wales Island, are said to show auriferous copper ores, of good grade, with considerable development.

SILVER MONUMENT MINE. **NEW MEXICO.**

Mine office: Chloride, Sierra Co., N. M. B. S. Phillips, superintendent, at last accounts. Ores carry silver, gold and copper. Has steam power and a 5-stamp mill.

SILVER MOUNTAIN MINING CO. **COLORADO.**

Mine office: Empire, Clear Creek Co., Colo. Ores carry gold, silver and copper. Has steam power and a small stamp-mill.

SILVER SHIELD MINING CO. **UTAH.**

Office: care of H. S. Joseph, manager, Salt Lake City, Utah. Mine office: Bingham Canyon, Salt Lake Co., Utah. Employs circa 20 men. Lands, sundry claims, showing a 4′ vein, giving assays of 8% to 10% copper, 15 oz. to 100 oz. silver and $9 to $15 gold per ton, from selected ores. The

mine also shows a little silver-lead ore, of good grade, and has a considerable body of low-grade milling ore. Mine has made some concentrates, at the Kempton mill, and management is said to have secured land, from the Boston Consolidated, near the mouth of the Silver Shield tunnel, for a millsite, and to plan building a 60-ton concentrator thereon. Company proposed consolidating with the United Bingham, March, 1906, but the consolidation was not effected.

SILVERSMITH MINE. **MONTANA.**

Letter returned unclaimed from former mine office, Basin, Mont.

SILVER SPUR MINING CO. **AUSTRALIA.**

Office and mine: Silver Spur, Stanthorpe Co., Queensland, Australia. Employs circa 100 men. Robert T. Vyner, chairman; Edgar Hall, secretary, treasurer and general manager; Henry Wann, mining captain. Organized 1898, under laws of Queensland, with capitalization £24,000, shares £1 par, 15s. paid in. Has paid dividends of £18,300.

Lands, 49 acres, leasehold from the crown, showing 4 lenses, averaging 8′ in width and 100′ in length, with varying depths, carrying sulphide ores, returning 1% copper, 12% lead, 20% zinc, 25 oz. silver and $1 gold per ton. Has shafts of 100′, 180′ and 300′, with about 12,000 tons of ore blocked out for stoping. Has a steam plant, including hoist, 5-drill air-compressor, crusher. Chilean mill and a sawmill.

The smelter, which receives ore by tram-line, has two 42x100″ Austin water-jacket pyritic blast-furnaces, of 60 tons daily capacity each, and 2 reverberatory furnaces, daily capacity 15 tons each. Product is turned out as 33% matte, carrying 900 oz. to 1,000 oz. silver per ton, sent to Europe for refining. Production, 1903, was 71,680 lbs. fine copper, and 1904 was 98,560 lbs. fine copper.

SILVER TIP GOLD MINING CO. **WASHINGTON.**

Office: Tacoma, Wash. Letter returned unclaimed from former mine office, Maple Falls, Whatcom Co., Wash. Ores carry gold, silver and copper.

SILVERTON MINING CO. **COLORADO.**

Mine office: Silverton, San Juan Co., Colo. J. H. Starkweather, superintendent, at last accounts. Lands, on Sultan Mountain, include the North Star mine, producing ores of gold, silver and copper. Has steam and water power and a 60-stamp mill.

SILVERTON MINING CO. **WASHINGTON.**

Mine office: Silverton, Snohomish Co., Wash. Was developing a vein, carrying ores of gold, silver and copper, near the Bonanza Queen mine, at last accounts. Presumably idle.

SILVER WING MINE. **COLORADO.**

Mine office: Animas Forks, San Juan Co., Colo. Has a 25-ton leaching plant, completed late in 1905, using the Waterbury process. Ores are roasted, before leaching with sulphuric acid made from the roast fumes. Management is said to plan enlarging the plant to a permanent 200-ton mill if the process proves successful.

SIMILKAMEEN COPPER MINES. **BRITISH COLUMBIA.**

Stuart Armour, president, at last accounts. Capitalization $200,000, shares 10c. par. Lands, supposedly somewhere in the Similkameen district of British Columbia. Presumably moribund, or dead.

SIMILKAMEEN MINING & SMELTING CO., LTD. **BRITISH COLUMBIA.**

Office: care of Chas. F. Law, secretary, Vancouver, B. C. Fred Buscombe, chairman; W. H. Armstrong, managing director; preceding officers, E. J. McFealey and Clarence Marpole, directors. Organized 1905, under laws of British Columbia, with capitalization $2,000,000, shares $10 par.

Lands, 5 claims, 3 crown-granted, area circa 200 acres, known as the St. Lawrence and St. George groups, 8 miles from Tulameen City, on Bear Creek, a tributary of the Tulameen river, in the Similkameen division of the Boundry district of British Columbia. Lands are well timbered and have a 250-h. p. available waterfall, on Bear Creek. Development is by 4 shallow shafts, of circa 50′ depth each, a short tunnel, and numerous trenches and open-cuts. The property shows a strong ore body, between schist and granite, with intrusive porphyry dikes. The St. Lawrence mine has two 50′ shafts, showing an 8′ vein of massive cupriferous iron sulphides, giving average assays of about $10 per ton in copper, silver and gold. The St. George group shows a 4′ vein, carrying ore with quartz gangue, giving average assays of 1.38% copper, 2.08 oz. silver and $53 gold per ton. Property is considered promising.

SIMSBURY MINE. **CONNECTICUT.**

A small, old and idle mine, at Granby, Hartford county, Connecticut.

SINAI MINING SYNDICATE. **ARABIA.**

Mine office: Mt. Samarah, Arabia, care of G. Beyts & Co., Suez, Egypt. M. Wanner, mine manager. Property is sundry old copper mines, worked by the early dynasties of Egyptian kings, and abandoned probably some 1,500 years before the Rio Tinto was first opened by the Phœnicians, which latter event occurred circa 1100 B C.. A little work was done, in 1903. Presumably idle.

SINALOA EXPLORATION CO. **MEXICO.**

Office: Commonwealth Trust Bldg., St. Louis, Mo. Geo. B. Clark, president; Dr. H. H. Born, secretary; Chas. Wiggins, treasurer; preceding officers, Chas. H. Filley, John Hartman, Henry Leschen, Chas. M. Rhoades and W. S. S. Rodgers, directors. Capitalization $500,000, shares $1 par. Lands, sundry claims, also 7 square miles of miscellaneous timber and mineral lands, circa 80 miles northeast of Mazatlán, in the state of Sinoloa, Mexico. Property included the Santa Eduwiges and La Luz mines, which have been disposed of, for stock interests, to the Metates Mining Co., and one other new corporation.

SINALOA & SONORA MINING & SMELTING CO. **MEXICO.**

Office: 1133 Broadway, New York.

SINBAD MINE. **MONTANA.**

Mine office: Butte, Silver Bow Co., Mont. Lands lie just north of the Pittsburg & Montana, in East Butte, and are opened by a shaft of circa 600′ depth.

SISKIYOU COPPER MINING CO. **CALIFORNIA.**

Office: care of G. W. Holmes, Chatham, Ont. Mine office: Ashland, Jackson Co., Ore. Employs 12 men. Dr. J. F. Reddy, manager. Lands, sundry claims, in vicinity of the Blue Ledge mine, upper Applegate district, Siskiyou county, California, including the Cook & Green claims, adjoining the Blue Ledge mines, near the Oregon line, developed by a 250′ tunnel, said to give a promising showing of ore.

SISKIYOU GOLD & COPPER CO. **CALIFORNIA.**

Office 326 Post St., San Francisco, Cal. Mine office: Rollins, Siskiyou Co., Cal. Lands, said to be 8 claims, area 160 acres, on the state road between Yreka and Rollins, Siskiyou county. Regarded with deep suspicion, because stock was peddled by the notorious "Baron" W. E. von Johannsen, of the Pacific States Mining & Investment Co.

SISKIYOU GOLD & COPPER MINING CO.

Letter returned unclaimed from former office. Salt Lake City, Utah.

SISKOWIT MINE. **MICHIGAN.**

Located near Rock Harbor, Isle Royale, Michigan. Has a 5′ amygdaloid vein, carrying sheet copper, in contact with walls, opened by a 500′ main shaft. Worked 1845–1855, making circa 150 tons fine copper, and since idle.

MINA LA SIVERIA. **MEXICO.**

Office and mine: care of E. Torres, owner, Topia, Durango, Mexico.

SIX EAGLES MINING CO. **WASHINGTON.**

Office: Olympia, Wash. Mine office: Loomis, Okanogan Co., Wash. Robt. Frost, superintendent, at last accounts. Has auriferous and argentiferous lead and copper ores, with steam power.

SJANGELI MINES. **NORWAY & SWEDEN.**

Mine office: Sjangeli, Norway. Lands, circa 30 miles from the coast, with good water power available, include the Sjangeli, Mina Alakats, Valfojokk and Ruopsuokjaure groups, partly in Norway and partly in Sweden. Country rocks are hornblende schists, with narrow strata of limestone and lenticular bodies of massive gabbro, ores occurring in the schists as cuprite, chalcocite, bornite and chalcopyrite, assaying 2.5% to 55% copper, with an average tenor of about 12.5%. Property, though but slightly developed, is considered decidedly promising.

SKOVVASFJELDETS AKTIEBOLAG. **NORWAY.**

Mine office: Harran, Norway. N. Tiskum, manager, at last accounts.

SKYLARK COPPER MINING & MILLING CO. **UTAH.**

Office: 40 Commercial Blk., Salt Lake City, Utah. Letter returned unclaimed from former mine office, Blue Acre, Beaver Co., Utah. A. J. McMullen, president and general manager; E. A. Cook, secretary and treasurer. Organized May, 1899, under laws of Utah, with capitalization $75,000, shares 25c. par. Is under same management as O. K. Extension Mining & Reduction Co. Lands, 10 claims, area 200 acres, in the Beaver Lake district, showing a 4′ contact vein between limestone and granite, opened by shafts of 150′ and 365′ and by 6 tunnels, longest 155′, showing chalcopyrite

and galena, former estimated by company to average 5% copper and 6 oz. silver, and latter 40% lead, 76 oz. silver and $2.50 gold per ton. Has gasoline power. Property regarded as promising.

SLATE CREEK MINING CO. **ARIZONA.**

Letters returned unclaimed from former office, Cleveland, Ohio, and former mine office, Prescott, Yavapai Co., Ariz.

SLATE CREEK MINING & MILLING CO. **WYOMING.**

Mine office: Wheatland, Laramie Co., Wyo. M. F. Montgomery, superintendent, at last accounts.

SLATER COPPER MINES CO. **MISSOURI.**

Office: Willow Springs, Mo. Lands are in Shannon county, Missouri. Idle since circa 1901.

SLEEMINABAD COPPER CO. **INDIA.**

Office: care of P. C. Dutt, manager, Residency Road, Jubbulpore, Central Provinces, India. Lands are sundry claims, 1½ miles from the station of Sleeminabad, on the East Indian Railroad, 40 miles from Jubbulpore, and 650 miles from Bombay, almost in the centre of India. The formation is of Silurian age, country rocks being dolomite, slate, quartzite, mica-schist and jasper, much crumpled and metamorphosed, with numerous porphyry dikes, ore occurring in the vicinity of the porphyry. The Dharwar schists, here seen, belong to the same geological horizon as the Kolar gold fields. Country rocks have a generally east and west strike, and southern dip, with veins occurring at approximately right angles and having a westerly dip. The veins have well defined walls, with considerable fluccan, showing slickensides. The property shows 16 veins, in a radius of 10 miles, veins averaging 6′ width, one vein outcropping for nearly 2 miles. Development is by a 100′ vertical shaft, and considerable diamond drilling has been done, showing auriferous and argentiferous malachite and tetrahedrite, giving assay values, according to the Indian Government Survey, up to 25% copper, 197 oz. silver and 15 dwts. gold per long ton. Ore produced has been sold for £7 5s. 6d. per ton. Property is considered worthy of careful investigation.

SLIDE ROCK CLAIMS. **MEXICO.**

Office: care of Alpheus McCallum, 162 Randolph St., Chicago, Ills. Mine office: Magdalena, Socorro Co., N. M. Lands, 6 claims, area 120 acres, in the Magdalena district, 2 miles from the Santa Fé railway, held under bond and lease by Alpheus McCallum, Dr. Alex. McCallum and Dr. W. W. McCallum. Property is developed by tunnels of 120′ and 200′, showing ore assaying 21.2% copper, 6 oz. silver and $19.84 gold per ton, with occasional lead and zinc values.

SMELTING & REFINING COMPANY OF AUSTRALIA (1901), LTD. **AUSTRALIA.**

In voluntary liquidation, December, 1905, and practically succeeded by Australian Smelting Corporation, Ltd.

SMOKEHOUSE MINING CO. **MONTANA.**

Office and mine: Butte, Silver Bow Co., Mont. Bernard Noon, general manager, at last accounts. Has a 500′ two-compartment shaft. Idle.

SMUGGLER GOLD & MINING CO. **WASHINGTON.**

Office: 202½ Stark St., Portland, Ore. Mine office: Index, Snohomish Co., Wash. Employs 4 men. McKinley Mitchell, president; Samuel Hart, secretary; D. S. Williams, treasurer; W. J. Walters, general manager. Organized July, 1904, under laws of Washington, with capitalization $1,000,000, shares $1 par: issued, $600,000. Lands, 19 claims, in the Silver Creek district.

SNOHOMISH & TRAMWAY MINES. **MONTANA.**

Mine office: Butte, Silver Bow Co., Mont. John S. Harris, receiver. Courts have decided that the Butte & Boston Consolidated Mining Co. owns two-thirds of the Tramway and one-half of the Snohomish, balance going to the Butte Coalition Mining Co.

SNOWBIRD MINE. **MONTANA.**

A property at Butte, Silver Bow county, Montana, formerly in dispute between the Montana Ore Purchasing Co. and the Anaconda Copper Co. Title now rests between the Anaconda and Butte Coalition companies.

SNOWSHOE COPPER MINING CO. **MONTANA.**

Supposedly has copper claims, somewhere in Montana. Diaphanous.

SNOWSHOE GOLD & COPPER MINES, LTD. **BRITISH COLUMBIA.**

Offices: 7, Poultry, London, E. C., Eng. Mine office: Phœnix, B. C. Earl of Chesterfield, chairman; Geo. S. Waterlow, D. L., J. P., vice-chairman; H. W. Batty, secretary; Anthony J. McMillan, managing director; J. W. Astley superintendent; J. H. Trevorrow, mining captain. Organized Jan. 20, 1901, under laws of United Kingdom, with capitalization £250,000, shares £1 par; issued, £198,855. Lands, 4 claims, area 120 acres, freehold, about ¼ mile from the Granby, in the Grand Forks or Boundary division of the Yale district. Ore occurs, exclusively as chalcopyrite, in fissure replacements, ranging 25′ to 200′ in width, with an average of about 100′, by 1,000′ length. Ore occurs occasionally in distinct bodies, somewhat mixed, but is mainly disseminated in minute particles throughout a gangue varying from silicious to calcareous, and carrying occasional magnetite and specular hematite. Experiments in electrolytic reduction, conducted on this ore by Thos. A. Edison, did not result successfully. The mine has tunnels of 200′, 250′ and 600′, with shafts of 200′ and 300′, the main shaft having 3 compartments, with a 150-h. p. double-drum electric hoist, raising 2-ton skips, but bulk of production is secured from open-cast workings.

Machinery plant includes a 30-drill Rand Corliss cross-compound condensing steam and compound air-compressor. Production was 20,000 tons of ore in 1902, and 74,000 tons in 1903, mined at an average cost of $1.10 per ton. Ore was shipped to smelters at Greenwood and Boundary Falls for reduction, the mine having direct rail connection with the Canadian Pacific line. A merger of the Snowshoe with the British Columbia Copper Co. was under consideration for some time, but was not effected. The ore body is low in grade, but of great size, and worked upon the scale of other big ore bodies of the same district, with equal capital and skill, the Snowshoe should make a successful mine.

SNOWSTORM GOLD & SILVER MINING & MILLING CO. **COLORADO.**

Mine office: Durango, La Plata Co., Colo J. E. Downer, manager, at last accounts. Ores carry gold, silver, copper and mercury. Has water power and a 10-stamp mill. Presumably idle.

SNOW STORM MINING CO. **IDAHO.**

Office and mine: Mullan, Shoshone Co., Idaho. Employs circa 150 men. H H. Burns, president; Thos. Donnelly, vice-president and general manager; F. J. Edwards, secretary and treasurer; J. H. Hewand & Co., lessees. Organized 1899, under laws of Idaho, with capitalization $1,250,000, shares $1 par.

Lands, 8 claims, 6 patented, area 160 acres, also a 2-acre millsite, in the Hunter district, showing a fissure vein of 10′ to 60′, with an average of circa 20′ width, opened by a 200′ shaft and by tunnels of 200′, 600′ and 1,800′, with about one mile of workings, estimated by company, early in 1905, to show 500,000 tons of ore blocked out for stoping. Ores, as developed, are oxides and carbonates, with silicious gangue, being especially suited for converter linings. An average of 6 general assays, in 1905, gave 10.9% copper, 11.6 oz. silver and 50 cents gold per ton, from a 14′ breast on the 1,000′ level. The mine has a water power plant, and an experimental leaching plant. A 7,300′ tramline leads from No. 2 tunnel to the Larson railway spur.

The upper levels of the mine are operated, under a 5-year lease, on royalty, by Messrs J. H. Hewand and Thos. L. Greenough, under the firm name of J. H. Hewand & Co. Mr. Greenough and his associates are said to own nearly 75% of the stock of the company, and have urged the levying of an 8-cent assessment, for the further equipment of the mine. The minority shareholders are bitterly opposed to this assessment, stating that Mr. Greenough and his associates, through the profits of their lease, are in a position to pay the assessment on their stock, while the minority shareholders would have to dig up the cash from their pockets. There is considerable force in this argument, but, as a matter of fact, there can be little doubt that the 8-cent assessment, if expended properly, would add at least ten times that amount to the value of the property, and careful investigation of the facts in the case does not show that the lessees have been gouging the property. The basis for the animosity displayed toward them lies, apparently, in the fact that the lessees are earning very handsome profits—which they seem entitled to, from their courage in putting their own cash into the property.

The mine has considerable development, and some excellent reserve stopes. More or less ore has been shipped since 1904, and production, for 1905, is estimated at 55,000 tons of ore, carrying 4,950,000 lbs. fine copper. Property is considered of much promise.

SOCORRO GOLD CO. **ARIZONA.**

Office and mine: Harrisburg, Yuma Co., Ariz. Geo. D. Workman, president; S. C. Workman, secretary; F. C. Smith, general manager. Organized 1901, under laws of Arizona, with capitalization $500,000, shares $1 par. Lands, 10 claims, area 200 acres, in the Ellsworth district, showing a fissure vein of 2′ width, carrying covellite and chalcopyrite, assaying about $10 gold and 5 oz. silver per ton, with small copper values, developed by a 667′ shaft

and 11 tunnels, with 2,467′ of underground workings, having 5,000 tons of ore blocked out for stoping. Has a 20-stamp mill, 3 Standard concentrators and cyanide plants of 10 tons and 50 tons daily capacity.

SOLACE COPPER MINING CO. **ARIZONA.**

Office and mine: Globe, Gila Co., Ariz. Ignatius Schlinger, president and treasurer; Henry Smith, vice-president; A. P. Murray, secretary; T. Schlinger, treasurer. Organized 1903, under laws of Arizona, with capitalization $500,000, shares $1 par, in $100,000 preferred and $400,000 common shares. Lands, 4 claims, in the Bloody Tank district, circa 8 miles from Globe, showing 4 ore bodies, of 20′ average width, opened by several pits, giving assays of 8% copper and $15 gold per ton.

MINA SOLEDAD. **MEXICO.**

Office and mine: care of Dr. S. H. Quint, Ameca, Jalisco, Mexico. Chris. O'Brien, manager. Lands, 78 pertenencias, circa 12 miles southwest of Ameca, in the Sierra Tetilla district, opened by about 1,600′ of shafts and tunnels. Deepest workings 400′, with sulphides below the 200′ level, showing circa 10,000 tons of ore, in a 12′ vein carrying copper and free gold, values being mainly gold. Equipment includes a 3-stamp Hendy mill, 1 Wilfley table and 1 Pender concentrator.

SOLMS-BRAUNSFELS'SCHE BERGWERKE. **GERMANY.**

Mine office: Braunsfels, Rheinprovinz, Germany. Herr Bergassessor Bellinger, manager. Has ores of iron, manganese and copper.

SOLOMON SPRINGS COPPER MINING CO. **ARIZONA.**

Office and mine: Naco, Cochise Co., Ariz. Lands, 20 claims, area 400 acres, in the Naco valley, about midway between Bisbee and Naco. Lands show a vein having a gossan of 4′ to 40′ width. Was under bond, for several years, to the Houghton Development Co.

SOMBRERETE MINING CO. **MEXICO.**

Mine office: Sombrerete, Zacatecas, Mexico. Is an extensive silver-lead property, controlled by the Compañía Metalurgica Mexicana.

SONGATOF MINE. **RUSSIA.**

A small producer, in the Russian Altai.

SONOMA MINES OF MEXICO, LTD. **MEXICO.**

Offices: 4, Great Winchester St., London, E. C., Eng. Mine office: Avino, Durango, Mex. G. H. Johnson, secretary; W. B. Jeffrey, mine manager; E. L. Wagner, superintendent. Organized Nov. 4, 1899, with capitalization £500,000, shares £1 par; issued, £450,400. Lands, 415 acres, carrying ores of gold, silver and copper, the Sonoma claims showing a large body averaging 2.5% to 4% copper, with fair gold and silver values, while the Malinche claim is said to show ore carrying up to 10% copper, with small gold and silver values. Has steam power.

SONORA BONANZA MINING CO. **MEXICO.**

Office: La Cananea, Sonora, Mex. Mine office: Imuris, Sonora, Mexico. W. M. Barker, president and general manager; Hon. Chas. Smith, vice-president; R. E. Lopez, secretary; Wm. Gmahling, treasurer; John E. Penberthy consulting engineer; Chas. Hanley, superintendent. Organized July 2,

1904, under laws of Arizona, with capitalization $1,000,000, shares $1 par.

Lands, 135 pertenencias, with extensive holdings of miscellaneous lands, circa 25 miles south of Nogales. The mine shows a prominent outcrop, of 10′ average width, traceable 1½ miles, the gossan giving quite uniform assays of $6 to $7 gold per ton. The vein, of 6′ to 10′ average width, shows a 3′ paystreak carrying galena, chalcopyrite and wulfenite, with silver values, and with occasional free gold. The molybdenum deposits are considered promising. The mine has ore-loading pockets on the 100′ and 200′ levels of shafts of 250′ and 350′ depth. The San Miguel property was idle, at last accounts, the formation being much disturbed.

Equipment includes a steam plant with 3 boilers, 2 hoists and 2 pumps, and an electric light plant and a new air-compressor are to be installed. Water is secured from a well, and a storage reservoir has been built, to hold the mine-water. The company has a general store and sundry dwellings for employes, and also has a lime-kiln, small brick-plant and a small concentrator, latter completed May, 1906. Property is considered promising.

SONORA CHIEF MINING CO. **MEXICO.**

Office: 323 American Bank Bldg., Kansas City, Mo. Mine office: Suaqui de Batuc, Ures, Sonora, Mexico. L. H. Jansen, president and general manager; Dr. M. T. Runnels, vice-president; Dr. C. L. V. Hedrick, secretary and superintendent; Harry Haldemann, assistant secretary and treasurer; preceding officers, A. H. Glasner and W. T. Cramer, directors; Morris Hesse, mine superintendent. Organized July 18, 1904, under laws of Arizona, and procotolized, October, 1905, under laws of Mexico, with capitalization $1,500,000, shares $1 par; issued $1,380,000. Statement, as of March 1, 1906, gave cash on hand, $17,000, and cash due company $9,000, without accrued liabilities.

Lands, 11 claims, area 464 acres, in the Ures district, with country rocks of granite-porphyry, diorite and limestone, showing several large, continuous ore bodies, of which 4, under development, are of 5′ to 6′ average width, carrying ores giving average assays of 15.8% copper, 10 oz. to 80 oz. silver and $25 to $49 gold per ton. Company says that 10% of production is auriferous and argentiferous whitneyite, an arsenical ore of copper. Development is by shafts of 95′ and 125′, and by tunnels of 25′, 754′ and 248′, with a total of 2,186′ of underground workings. Development is mainly at the Phœnix group, the Lakeside group being held in abeyance. The Yaqui river has an available waterfall, estimated at 440 h. p. The new line of the Southern Pacific will pass within one mile of the mine. Company plans continuing development and building a modern concentrator, during 1906.

SONORA COPPER COMPANY OF MEXICO. **MEXICO.**

Assets, consisting of a lawsuit, sold to Puertecito Copper Co.

SONORA DEVELOPMENT CO. **MEXICO.**

Office: 603 New Ridge Bldg., Kansas City, Mo. Mine office: Moctezuma, Sonora, Mex. Wm. Huttig, president; John W. Amerman, secretary; Jas. E. Lawrence, engineer. Organized under laws of Arizona, with capitali-

zation $1,000,000. Lands, 98 pertenencias, area 242 acres, including the Don Genaro y Anexas, Nacozari Copper Queen, Wostenholm, Conforme, Goodlander, Santa Clara, Cuahtemoc and La Verde groups. The Nacozari Copper Queen, area circa 65 acres, lies between the Nacozari and Belle Union mines of the Moctezuma Copper Co., giving ore assaying up to 58% copper. Some development has been secured, by shafts and tunnels, the mine openings being of somewhat random occurrence, showing ores carrying argentiferous and auriferous copper and lead sulphides. There is said to be a possibility of litigation over some of the properties claimed by the company, and the mining operations of the company are of a very languid nature.

SONORA & KANSAS CITY DEVELOPMENT CO. **MEXICO.**

Letter returned unclaimed from former office, Kansas City, Mo. Mine office: Suaqui de Batuc, Ures, Sonora, Mexico.

SONORA MINING CO. **MEXICO.**

Office: 201 Ward Blk., Battle Creek, Mich. Mine office: Aguacaliente de Baca, Sinaloa, Mexico. J. C. Barber, president; D. L. Merrill, vice-president; A. W. Davis, secretary and treasurer; preceding officers, J. W. McCrea, A. E. McBeth, H. G. Barber and H. A. Clapp, directors; E. A. Clapp, general manager; D. H. Livingston, superintendent; S. C. Whipple, engineer. Organized 1901, under laws of Wyoming, with capitalization $2,000,000, shares $1 par; issued, $1,250,000.

Lands, 149 pertenencias, area 368 acres, also 150 acres pasture lands, in the Alamos district of Sonora, with country rocks of granite-porphyry and limestone, showing sundry fissure veins, carrying lenticular ore bodies, of which 4 are slightly developed by 5 shafts, deepest 105', and by about 1,700' of tunnels, the four veins have average widths of 15', 12', 10' and 3', giving assays of 6.8% to 18.7% copper, 9% to 13% lead, 17.8 oz. to 30 oz. silver, and $1 to $2 gold per ton, from oxide and carbonate ores, vein changing to heavy sulphides at little depth. Company plans continuing development and building a 15-ton wood-burning reverberatory furnace.

SONORA MINING & DEVELOPMENT CO. **MEXICO.**

Letter returned unclaimed from former mine office, Hermosillo, Sonora, Mexico. Was said to have a property showing auriferous and argentiferous copper ore, of good grade, also a graphite mine, from which several hundred tons of plumbago are said to have been shipped.

SONORA MINING & MILLING CO. **MEXICO.**

Succeeded, Feb. 15, 1906, by Juarez Mining Co.

SONORENSE PROSPECTING & DEVELOPING CO. **MEXICO.**

Letter returned unclaimed from former office, Nogales, Ariz. Allen T. Bird, president; L. C. Frank, vice-president and general manager; M. E. Hopwood, secretary; John M. Woodrum, treasurer. Organized August 17, 1905, under laws of Arizona, with capitalization $1,000,000, shares $5 par. Lands, sundry properties, in the Ures district, between Hermosillo and Guaymas.

MINA SOQUITE PRIETO. **MEXICO.**

Mine office: Ayutla, Jalisco, Mexico. Lands, 150 pertenencias, showing

auriferous and argentiferous copper ores. Has a 35-ton mill, and at last accounts planned enlarging same.

JOSÉ SOSSI. **BOLIVIA.**

Office and mine: Coro Coro, La Paz, Bolivia. Is a small operator, having a mine equipped with steam power and employing 30 men, at last accounts.

COMPANHIA MINEIRA DE SOTIEL CORONADA. **SPAIN.**

Offices: Rua dos Sapateiros 22, Lisbon, Portugal. Mine office: Calañas, Huelva, Spain. Senhor Dom Augusto Fuschini, chairman; Thos. Morrison, & Co., agents at Calañas. Lands, 666 hectareas, including 34 old mines, carrying cupriferous iron pyrites. Is working steadily, in a rather small way. Production, 1904, was 14,994 long tons cupriferous pyrites and 614 long tons cement copper, estimated as equivalent to circa 1,000,000 lbs. fine copper.

SOCIEDAD ANONIMA MINAS DE SOTO. **SPAIN.**

Office: Bilbao, Spain. Mine office: Reinosa, Santander, Spain. Idle.

SOUTH AFRICAN COPPER ESTATES, LTD. **CAPE COLONY.**

Dissolved, September, 1904.

SOUTH AFRICAN GOLD & COPPER MINING SYNDICATE, LTD. **TRANSVAAL.**

Offices: 237, Finsbury Pavement House, London, E. C., Eng. E. G. Knights, chairman; E. C. C. Smith, secretary. Organized Nov. 24, 1903, with capitalization £15,000, shares £1 par, in £10,000 preferred and £5,000 ordinary shares; issued, all preferred shares, £10,000. Lands, 11,300 acres, held under option, southeast of Petersburg, in the Zoutpansberg district, Transvaal. It is stated that gold and copper ores have been found.

SOUTH AMERICAN DEVELOPMENT CO. **PERÚ.**

Succeeded, circa 1903, by Cerro de Pasco Mining Co.

SOUTH AUSTRALIAN COPPER SYNDICATE, LTD.

Offices: 13, St. Helen's Pl., London, E. C., Eng. Moribund.

SOUTH BISBEE COPPER MINING & TOWNSITE IMPROVEMENT CO. **ARIZONA.**

Wound up, 1904. Lands sold to Lake Superior & Pittsburg Mining Co.

SOUTH BUTTE COPPER MINING CO. **MONTANA.**

Office and mine: 47 East Broadway, Butte, Montana. P. J. Gilroy, president; W. J. Kemper, treasurer; F. E. Whitehead, secretary; James Davidson, general manager.

SOUTH CANANEA COPPER MINING CO., S. A. **MEXICO.**

Is the Mexican corporation of the Pennsylvania & Cananea Copper Co.

SOUTH COLUMBUS MINING CO. **UTAH.**

Office: care of Walter L. Maas, secretary and treasurer, Salt Lake City Utah. Mine office: Park City, Summit Co., Utah. Anthony O. Jacobson, president; J. Alexander Jacobson, vice-president; Arthur Snow, manager. Organized Feb. 11, 1904, as successor of the Centennial-Bingham Mining Co., with capitalization $300,000, shares $1 par. Lands, 70 acres, also 6 acres surface rights, circa 4 miles from Park City. Development is by a 1,050′ tunnel, showing slightly auriferous and argentiferous copper and lead sulphides, averaging circa 3.5% copper. Was idle at last accounts.

SOUTH-EAST AFRICA, LTD. **MOZAMBIQUE & ZAMBESIA.**

Offices: 84, Bishopsgate St., London, E. C., Eng. Dr. Carl Peters, managing director; T. M. C. Steuart, secretary. Organized July 11, 1898, as Dr. Carl Peters' Estates & Exploration Co., Ltd., and name changed to present title, October, 1903, with capitalization £150,000, shares £1 par; issued, £108,330. Debentures, £10,000, at 6%. Has the right to locate 500 claims, of 500 acres each, on the lands of the British South Africa Chartered Company, and a similar number of claims, of similar area each, on lands of the Mozambique and Zambesia companies, and has located 100 copper claims and 305 gold claims, on which some exploratory work has been done.

SOUTHERN COPPER CO.

Organized, February, 1905, under laws of Maine.

SOUTHERN COPPER MINING CO. **UTAH.**

Office: care of J. M. Reynolds, secretary, treasurer and general manager, Salt Lake City, Utah. Mine office: Milford, Beaver Co., Utah. J. K. Persons, president; B. J. Persons, vice-president; Ed. Mills, superintendent. Organized, May, 1905, under laws of Utah, with capitalization $300,000, shares $1 par.

Lands, 5 claims, area 100 acres, surveyed for patents, known as the Brooklyn group, circa 10 miles north of Milford, adjoining the Wahsatch King Mining Co. Development is by a 60′ shaft and 200′ tunnel, latter cutting a vein carrying fair values in copper, silver and gold.

SOUTHERN PACIFIC GOLD & COPPER MINING CO. **UTAH.**

Office: care of J. W. Burnham, secretary and manager, Salt Lake City, Utah. Capitalization $300,000, shares 50c. par. Lands, in the Sierra Nevada district, Box Elder county, Utah, are said to show high-grade ores, carrying good values in gold, silver and copper.

SOUTHERN SMELTING & REFINING CO. **TEXAS.**

Letters returned unclaimed from alleged office in New York, and from alleged works office, El Paso, Texas. Louis Strauss, president. Was said, October, 1905, to have taken the Federal smelter, at El Paso, under lease, with option of purchase. Presumably abortive.

SOUTHERN SONORA DEVELOPMENT CO. **MEXICO.**

Office: 135 Adams St., Chicago, Ills. Mine office: Alamos, Sonora, Mexico. Employs 25 men. Frederick E. Mills, president; L. W. Winchester, vice-president; L. E. Ballou, secretary; A. P. Ballou, treasurer and general manager; preceding officers, F. B. Smith and W. W. Strong, directors; J. R. Hendra, superintendent. Organized July 1, 1904, under laws of Arizona, with capitalization $1,000,000; shares $1 par; issued, $550,000. Lands, 28 pertenencias, area 69 acres, held under name of San Bernardino Mining Co., which presumably is the Mexican incorporation, in the Alamos district, showing country rocks of granite and diorite, carrying various fissure veins, of which the Santo Domingo vein is of 14′ average width, and is traceable 3,200′; the Quebradilla vein is estimated at 15′ average width and the Santa Ana at 8′ average width. Development is by a 300′ shaft,

with 360′ of workings, estimated to show 15,000 tons of carbonate ore, assaying 2% copper, 5% lead, 67 oz. silver and $42 gold per ton. Equipment includes an 80-h. p. hoist, good for 1,500′, a store, assay office and mill, latter not in use. Company plans installing a 100-ton concentrator.

SOUTHERN STAR COPPER & SMELTING CO.

Letter returned unclaimed from former office, St. James Bldg., New York.

SOUTHERN ZINC & COPPER MINING CO. **ARKANSAS.**

Office: 708 University Ave., Rochester, N. Y. Mine office: Gillham, Sevier Co., Ark. E. J. Morley, president; E. S. Osborne, assistant secretary and general manager. Organized May 3, 1903, under laws of Arkansas, with capitalization $2,000,000, shares $100 par. Lands, 700 acres, in the Gillham district, opened by shafts of 135′ and 170′, said to show zinc ores. Is supposed to have a small milling plant. Was in debt, at last accounts, and presumably is idle.

SOUTH KEARSARGE MINE. **MICHIGAN.**

Owned by Osceola Consolidated Mining Co.

SOUTH MOUNT LYELL MINING CO., LTD. **TASMANIA.**

Offices: 153, Leadenhall St., London, E. C., Eng., and 320, Collins St., Melbourne, Victoria, Australia. Mine office: Gormanston, Montagu Co., Tasmania. G. Moore, acting chairman; H. M. Taylor, secretary in London; N. Madden, secretary in Melbourne; J. Ryan, mine manager. Capitalization, £600,000; issued, £496,150, shares £2 par, non-assessable. Lands, 93 acres on Mt. Lyell and 80 acres on Mt. Darwin, former carrying 4% to 6% sulphide ore. Has shafts of 90′ and 718′ and a 703′ main tunnel. Idle since June 1, 1903, apparently with slight prospects of resumption.

SOUTH PEACOCK MINING CO. **IDAHO.**

Office: 88 State St., Boston, Mass. Mine office: Weiser, Washington Co., Idaho. Thos. S. Wentworth, president; Wm. L. Pratt, secretary. Capitalization, $500,000. Lands are in the Seven Devils district. Idle.

SOUTH RANGE MINING CO. **MICHIGAN.**

Office: 60 State St., Boston, Mass. Mine office; Houghton, Houghton Co., Mich. R. R. Goodell, president; H. W. Wesson, treasurer; F. W. Nichols, secretary. Capitalization $2,500,000, shares $25 par. Lands, circa 7,000 acres, undeveloped, lying mainly between the Globe and Belt properties, in Houghton and Ontonagon counties, Michigan, and so located that future mining companies, carved out of new territory in this district, will have to see the South Range company, or organize with very jagged outlines, in many cases.

SOUTH SIDE MINING CO. **MICHIGAN.**

Office: care of John C. Watson, president, 68 Devonshire St., Boston, Mass. Mine office: care Fred W. Nichols, agent, Houghton, Houghton Co., Mich. C. O. Burbank, secretary and treasurer. Reorganized April, 1899, under laws of Michigan. Annual meeting, first Monday in March. Lands, circa 200 acres, lying west of the Dakota and north of the Naumkeag, immediately west of Houghton, with one half mile frontage on Portage Lake. Mining operations were confined to a little exploratory work, done many years ago.

SOUTH THARSIS MINE. **TASMANIA.**

Sold to Mt. Lyell Mining & Railway Co., Ltd.

SOUTHWEST AFRICA CO., LTD. **DAMARALAND.**

Offices: 3, Laurence Pountney Hill, London, E. C., Eng., and Unter den Linden 35, Berlin, Germany. E. Davis, chairman; C. Launspach, secretary. Organized Aug. 18, 1892, with capitalization £2,000,000, shares £1 par; issued, £1,200,000. Property is mineral concessions covering 22,000 square miles, including nearly 4,500 square miles of freehold, in Damaraland, and mining rights to 23,000 square miles in Ovamboland, total holdings including 40,000 square miles of freehold, with mining rights over 90,000 square miles additional, also sundry railroad concessions. It is planned to build a railway, to reach the very promising copper deposits on this company's holdings, in Damaraland.

SOUTHWESTERN CONSOLIDATED SMELTING CO. **CALIFORNIA.**

Office: 39 Cortlandt St., New York. F. C. Kaye, president; J. C. De Wolfe, treasurer; L. W. Thompson, secretary; E. Homer Grasty, manager. Organized August, 1904, with capitalization $2,000,000, shares $1 par. Company is said to have planned building a smelter somewhere in California. Apparently is merely a stock-jobbing device, promoted by Messrs. Kaye, DeWolfe & Co.

SOUTHWESTERN COPPER & IRON CO. **NEW MEXICO.**

Lands are leased to Burro Mountain Copper Co.

SOUTHWESTERN GOLD & COPPER CO. **ARIZONA.**

Letter returned unclaimed from former office and mine, Douglas, Cochise Co., Ariz.

SOUTHWESTERN MINE & SMELTING CO. **ARIZONA.**

Dead. Was organized, 1903, to build a custom smelter at Gleeson, Cochise county, Arizona.

SOUTHWESTERN MINING CO. **MEXICO.**

Office: 6 Berbting Bldg., South Bend, Ind. Mine office: La Cananea, Arizpe, Sonora, Mexico. Employs 25 men. A. B. Wiekiger, president; A. B. Wadleigh, vice-president and general manager; D. Miller, second vice-president; Hon. Dudley N. Shiveley, secretary; B. K. Morse, superintendent; F. G. Conklin, treasurer; preceding officers, E. E. Bondurant, C. A. Bondurant, S. M. Robinson, Geo. Young and N. E. Bailey, directors; Geo. A. Laird, consulting engineer; Pedro Robles, general counsel. Organized 1904, under laws of Arizona, with capitalization $1,000,000, shares $5 par. Operates through the Ortega Mining Co,. S. A., which is the Mexican incorporation. American Trust Company, South Bend, Indiana, registrar.

Lands, 342 hectareas, known as the Huerfano group, 6 miles southeast of La Cananea. Country rocks are quartzite, quartz-porphyry, altered rhyolite and altered limestone, somewhat similar to the formation at Cananea, carrying an 800′ ore zone, opened by a 150′ shaft, showing ores giving good assay values in copper, lead and silver. Active development was begun January, 1906.

SOUTHWESTERN SMELTING CO. **CALIFORNIA.**

Letter returned unclaimed from alleged works office, Oro Grande, San Bernardino Co., Cal. Presumably dead.

SOUTHWESTERN SMELTING & REFINING CO. **ARIZONA.**

Office: 302 Mills Bldg., San Francisco, Cal. Mine office: Johnson, Cochise Co., Ariz. Works office: Benson, Cochise Co., Ariz. Riley A. Boggess, president; A. J. Pidgeon, vice-president and general manager; Franklin Bowring, secretary; Walter L. Wiley, treasurer; Doane Merrill, assistant treasurer, smelter superintendent, and resident manager; preceding officers, S. H. Cummings and J. W. Wynne, directors; Mort Wien, superintendent; R. M. Johnson, mill superintendent. Organized 1904, under laws of Arizona, with capitalization $500,000, shares $10 par, in $100,000 preferred 7% stock and $400,000 common stock. Company succeeded the Empire Smelting Co., and holds title to mining lands, at Johnson, through the Arizona-Michigan Development Co., mine being described under that title.

The smelter-site, 80 acres, at Benson, is on the Southern Pacific railroad. The smelter has a 250-ton water-jacket blast-furnace and a 75-ton Kirk reverberatory furnace, burning petroleum. This plant never has been operated. Equipment of the smelter includes a Vezin 500-ton automatic sampler and a 35-h. p. General Electric motor. The sampler treated 600 tons of milling ore, March, 1905, and was then closed down, awaiting the development of the mine, through lack of capital to purchase ore. Company hopes to start up the sampling mill and smelter, late in 1906.

SOUTHWEST SMELTING & REFINING CO. **NEW MEXICO.**

Office: 517 Francis St., St. Joseph, Mo. Mine and works office: Orogrande, Otero Co., N. M. Employs 200 men. Geo. J. Green, president; Robert G. Mullen, vice-president and general manager; T. G. Travis, secretary and treasurer; Wm. A. Evans, assistant treasurer; Daniel B. Hunt, assistant secretary; preceding officers, Manfred M. Riggs, Arch. M. Woodson, John E. Lonsdale, Charles B. Hughes, Clinton P. Cockrill, Joseph P. Standley and Ichabod McCord, directors; J. S. Airheart, superintendent. Organized December 5, 1904, under laws of New Mexico, with capitalization $750,000, shares $100 par. Bonds, $150,000 authorized and issued, at 5%. Statement, as of date April 1, 1906, gave cash on hand, $195,000, without accrued liabilities. Annual meeting, third Tuesday of November. Company is practically a close corporation, and controls a number of allied and subsidiary corporations, including the New Mexican Land & Developing Co., which owns the townsite of Orogrande. Company succeeded to the holdings of the Three Bears Mining Co., and has added another mining properties, and is building a large reduction plant.

Lands, 36 claims, area 720 acres, also an 80-acre smelter-site and a 640-acre townsite, giving total holdings of 1,440 acres, in the Silver Hill district of Otero county and the Organ district of Donna Ana county, New Mexico. The principal holdings are in the Silver Hill district, in the Jarilla Mountains, circa 60 miles north of El Paso, and in addition to copper lands, the company holds sundry placer gold claims. The smelter-site is ¾ mile from Jarilla

Junction, on the main line of the El Paso & Northeastern Railroad. The company also owns a mine of auriferous iron ore, highly desirable for fluxing.

Country rocks are limestone and porphyry, carrying 16 different contact veins, of which 7 have been more or less developed, these ranging from 3′ to 40′ in width, with known lengths of 100′ to 700′, carrying native copper, cuprite, malachite and various sulphide ores, giving average assays of 7% copper, 2 oz. silver and $5 gold per ton. Principal mining properties are the Lucky, Nanny Baird and Iron Mask mines.

The Lucky mine is opened by a 300′ main working shaft, and by tunnels of 250′ and 625′, said to show a large amount of auriferous copper ore, averaging about 7% copper and $6 gold per ton. The mine has a 500′ tramway, leading to the railroad track.

The Nanny Baird mine is opened by a 100′ vertical shaft and an 800′ incline shaft. This property shows a vein of about 25′ average width, carrying small copper and silver values, and good gold values. It is planned to sink a 2-compartment vertical working shaft and equip same with a modern hoist. South of the Nanny Baird is a placer gold tract of promise. The Lucky and Nanny Baird, jointly, have 5,025′ of underground workings, estimated to show 100,000 tons of ore of good average grade blocked out for stoping.

The Iron Mask mine, on Iron Mountain, produces 60% iron ore, carrying $2 to $8 gold per ton, with an average of about $3 to $4. The company also owns a limestone quarry, for flux, which has been stated, in the press, to carry 80 cents to $6 gold per ton, which seems almost too good to be true. It is planned to reach the Iron Mask by a railroad spur.

Water is a scarce and valuable commodity in the Jarilla district, and the company is endeavoring to secure same by an artesian well of 2,000′, but is taking no chances on the well proving successful, and is to pipe water to the smelter, from the Sacramento river. A 10,000,000-gallon dam is to be built across the river, in the Sacramento Mountains, and a 6″ pipe line will carry this water, for 21 miles, to a 25,000,000-gallon reservoir on the side of Baird Hill, just above the townsite. The daily flow of the river is said to be 10,000,000 gallons, and water will be delivered under a head of 1,500′, at 800 lbs. pressure per square inch, hence should be capable of developing considerable power.

The mining plant includes three 85-h. p. boilers, two 8x10″ hoists, good for 800′ each, and 2 Sullivan air-compressors, of 28 drills aggregate capacity, also 23 power drills. The company has 22 buildings, including 4 smithies, a 20x40′ machine shop, general store, offices, laboratories, etc.

The townsite of Orogrande, owned by the company, has been built up quite rapidly. This has electric light and telephone service, maintained by the company.

The smelter, which is about 1½ miles from the mine, is of 400 tons daily capacity, having two 200-ton blast-furnaces. The furnace building is of steel, of good design. The power plant at the smelter includes 3 Heine 150-h. p. boilers, two 120-h. p. Filer & Stowell Corliss high-speed engines and two No 8

Connersville blowers. The smelter stack is 125′ high, of 14′ diameter at the base and 9′ at the top. The smelter is reached by a private spur track from the El Paso & Northeastern railroad, and is connected, by a branch line, with the mines. It is proposed to rebuild the tracks from the smelter to the mines, and extend same to the Iron Mask mine and the limestone quarry. The property is well located for the receipt of coal and coke, latter costing $6 per ton.

This is one of the most ambitious independent smelting enterprises in the southwest. The plant is well designed and is being well built. The location is good, and there is no reason apparent why the company should not do a large and profitable business, as it seems under good management, and adequately financed. It was hoped to blow in the smelter by September, 1906.

SOUTH WHEAL CROFTY CO. **ENGLAND.**

Offices and mines: Carn Brea, R. S. O., Cornwall, England. F. Harvey, chairman; C. H. Paull, purser. Is operated on the cost-book plan, with 6,120 shares. Has tin and copper mines, near Illogan, equipped with a mill having 60 stamps and 14 vanners.

SOUTH YALE COPPER CO., LTD. **BRITISH COLUMBIA.**

Mine office: Grand Forks, Yale district, B. C. Frederick Keffer, manager. Organized January, 1905, under laws of British Columbia, with capitalization $450,000, shares $1 par.

SOUTH YUBA MINING & SMELTING CO. **CALIFORNIA.**

Mine office: French Corral, Nevada Co., Cal. Lands, sundry claims, in the vicinity of French Corral, showing copper ores, said to be under bond to San Francisco parties, who plan erecting a smelter.

SOVEREIGN COPPER MINING CO. **WYOMING.**

Letter returned unclaimed from former mine office, Battle, Wyo.

J. SOWELL & CO. **OREGON.**

Mine office: Althouse, Josephine Co., Ore. Lands, sundry copper claims, slightly developed by tunnel. Idle at last accounts.

SPANISH COPPER CO., LTD. **SPAIN.**

Offices: 2, Tokenhouse Bldgs., London, E. C., Eng. Mine office: San Vicente, via Paimogo, Huelva, Spain. Organized June 8, 1883 with capitalization £150,000, shares £10 par; issued, £110,000. Chas. A. de Mancha, chairman; Wm. H. Nash and Miguel Yglesias, directors. Lands, 16 claims, area upwards 400 acres, 6 claims, area 200 acres perpetual leasehold, being held on an annual rental of £400, also 23 acres miscellaneous lands, in the Paimogo district of Huelva, showing 6 contact veins between porphyry and clay-slate, of which 3 are being developed, these averaging 30′ width and 500′ length, opened by numerous shafts of 30′ to 165′ depth, and 14 tunnels, longest 1,840′, estimated to show 2,500,000 tons of ore, with 100,000 tons blocked out for stoping. Ore is mainly cupriferous pyrites, said to average about 4% copper, 3 oz. silver and $2 gold per ton. Mines were first opened by the Phœnicians, reopened 1862, and again in 1872, 1883, 1901 and 1905. The Gaudina railroad is 5 miles distant.

SPANISH MINERALS DEVELOPMENT, LTD. **SPAIN.**

Offices: 157, Cannon St., London, E. C., Eng. Mine office: Almonáster, Huelva, Spain. J. B. White, chairman; S. Vivian, managing director; W. E. Hopper, secretary. Organized Sept. 4, 1900, with capitalization £150,000, shares £1 par; issued, £118,750. Lands, 476 acres, including the Angostura, Esperanza, Forzosa and other mines, carrying cupriferous iron pyrites. Has stripped the overburden from the Angostura mine, and plans beginning production during 1906.

SPAR COPPER MINES & TUNNEL CO. **COLORADO.**

Office: care of F. N. Stiles, president and general manager, Denver, Colo. E. A. Stiles, secretary; F. W. Downs, treasurer. Organized June 17, 1904, under laws of Colorado, with capitalization $600,000, shares $1 par. Lands, 9 claims, on Contact Mountain, Tomichi district, Gunnison county, Colorado, formerly known as the Morning Glim, having circa 1,500′ of workings, with gasoline power and 3 mine buildings,. Is said to have produced upwards of $75,000 worth of ore, in the past.

SPARONE MINES. **ITALY.**

A group of small producers, in Piedmont, Italy.

SPASSKY COPPER MINE, LTD. **SIBERIA.**

Offices: 60, London Wall, London, E. C., Eng. Mine office: Akmolinsk, Kirghiz Steppes, Siberia. Employs 1,500 men. Arthur Fell, M. P., chairman; preceding officer, F. H. Hamilton, H. A. Scott, J. Depelley and H. Moser, directors; Ernest Carnot, vice-chairman; John A. Clark, secretary; Union Bank of Scotland, Ltd., bankers; Arthur Fell and Ludwig Ehrlich, trustees for debentures holders; Ernest Nelson Fell, general manager; H. W. Mussen, mine superintendent; E. G. N. North, smelter superintendent; Pellew, Harvey & Fell, consulting engineers. Organized July 9, 1904, under laws of Great Britain, with capitalization £300,000, shares £1 par; issued, £275,000, fully paid. Debentures, £120,000 authorized, at 5%; issued, £102,400. Property was bought for £200,000 stock and £110,000 cash.

Lands, 100 square miles, including the Yuspensski mine, lying circa 160 miles south of Omsk on the Siberian railway, and the Spassky smelter, 72 miles from the mine. The lands of the company carry copper, gold, iron and limestone, and, in addition to the Yuspensski, there are sundry idle mines, in the vicinity of the smelter.

The Yuspensski mine shows a network of veins, occuring near the contact of slate and acid igneous rocks, ore being mainly sulphide. The two main veins, known as the Annensky and Vladimir, are about 200′ distant, and substantially parallel, hence it is thought that the two may join at depth. The mine has 35 different shafts, mostly shallow and in extremely bad condition, the mining practice of the former owners having been of the most rudimentary nature. Under the previous ownership timbering costs averaged $1.25 per ton of ore mined, and timbers were subject to frequent crushes, owing to bad mining, after which new timbers were installed inside of the old, with the result of eventually reducing the mine openings to impassable dimensions. The main shaft, known as the Annensky, is 350′ deep, sunk

vertically in the footwall and connected with the vein by crosscuts. The bottom level, at 350′, shows a vein of 38′ extreme and 15′ average width, carrying ore that has given actual smelter returns, under the present management, of 21.77% copper. This vein apparently is merely the paystreak of a vein of immense width, a crosscut on the bottom level showing, in addition to the paystreak, 651′ width of vein-matter, carrying declining copper values, ending with circa 1% copper, at the extreme end of the crosscut. It is probable that much of the vein hitherto untouched will be found workable, eventually. At one point the former owners had mined out the chalcopyrite, leaving a wall, showing slickensides, of what they considered slate, but which, upon investigation by the present management, proved to be a vein of massive chalcocite. Ore values are mainly in chalcocite, bornite and chalcopyrite with a little tetrahedrite, and gangue of quartz and barite, but the upper workings show more or less native copper, cuprite, malachite and azurite. The Yuspensski has been worked, in a primitive manner, since circa 1865, the original development having been by an open pit, once 150′ deep, but long long since caved in.

The old equipment at the mine was of a most primitive nature, and is being replaced by a modern plant. In addition to necessary shops, the company maintains schools, baths, a hospital and a church for workmen and their families. Transportation between the mine and smelter formerly was exclusively by carts, but the present company has bought a traction engine and ore-wagons. So much ore was lost in transit formerly, that the track of the ore-carts is emblazoned by a purple train of bornite, visible for several miles distance.

The coal mine, circa 20 miles from the smelter, shows two coal seams, of 60″ and 65″ thickness. The coal mine promises to be of commercial importance, in addition to furnishing all fuel for the mines and works, and the company plans building a railroad between the smelter and the coal field. Subsidiary companies may be formed, for the construction of the 72 miles of railroad required between mine and smelter, and for the development of the coal mines.

The old smelting plant was poorly designed, in bad condition, and remarkably inefficient, but has been patched up, until such time as the new plant can be constructed. The former practice scarcely could have been improved on for badness. The ore was heap-roasted with coal, the process requiring 3 weeks, and as the heaps were located on the top of a hill where furious winds prevailed, there was much cintering, and heavy losses. The old smelter had 6 rectangular brick furnaces, of 2½ tons daily capacity each, and so poor was the former practice that a smelter charge of 16 tons of ore required 54 tons of fuel and flux for its reduction. Matte was run onto the casting floor, of sand, with frequent pools of water, causing alarming explosions, and only about half of the matte was removed by tapping, the balance having been run out by hand. The slags ran about 3% copper, and were fed back into the furnace repeatedly.

The new smelting plant, on the way, July, 1906, is designed for a

productive capacity of 300 long tons fine copper monthly, and includes blast-furnaces and a converter plant. It is hoped to have the new smelter in blast before the close of the year. There are about 100,000 tons of very rich slags at the old works which will be resmelted later.

From July, 1904, to September, 1905, inclusive, 8,824 long tons of ore were smelted, giving average assay values of 21.77% copper, with an average monthly production 64 long tons of fine copper monthly. For the last 3 months of 1905, production averaged 105 long tons fine copper monthly. and production for 1905 is estimated at 2,500,000 lbs. fine copper, product being high-grade blister copper, assaying 99.6% fine. The Russian government has a protective tariff duty of practically 5 cents per pound on copper, and the Russian mines supply not to exceed 40% of the domestic consumption. Notwithstanding the disadvantage of a badly opened mine, an entirely inefficient and antiquated smelter, and long distance from railroad transport, the company made a profit of £33.000 on the first 15 months' operations, and with a modern plant and mining practice, profits should be very large. The management is good, and the Yuspensski mine is much the most promising copper mine of the Russian Empire, and scarcely is exceeded in promise by any new copper property of the world.

SPECULATOR MINING CO. **MONTANA.**

Property sold, 1905, to North Butte Mining Co.

DR. JAS. SPENCE & CO. **OREGON.**

Office and mine: Kerby, Josephine Co., Ore. Dr. Jas. Spence, general manager; C. W. Spence, superintendent. Lands, 11 claims, area 220 acres, showing country rocks of diorite and porphyry, carrying sundry veins, of which 4, under development, are estimated to be of 4′ to 100′ width, showing cuprite, melaconite, malachite, azurite and chalcopyrite, latter predominating, giving assays of 3% to 25% copper, 1 oz. to 6 oz. silver and $2 to $10 gold per ton. Development is by a shaft of 100′ and by tunnels of 700′, 140′, 230′, 180′ and 175′, with a total of 1,500′ of workings. Management plans continuing main tunnel to a length of 2,000′, equipping same with tramtrack and making sundry surface improvements. The intention is to develop the mine thoroughly before erecting a reduction plant, which is a sound plan of operation.

SPENCE MINERAL CO. **CALIFORNIA.**

Office: San Francisco, Cal. Mine office: Spenceville, Nevada Co., Cal. Chas. W. Howard, Jr., general manager. Is an old mine, operated since circa 1875, until main shaft caved in, 1903. Ores are auriferous and argentiferous sulphides, averaging about 5% copper and 45% to 50% sulphur, occurring in wide, irregular fissures, near the contact of diorite and granodiorite.

SPENTAZUMA COPPER CO. **ARIZONA.**

The notorious Dr. R. C. Flower began his career as a fake promoter by organising this company, which was supposed to have lands in the vicinity of Duncan, Graham county, Arizona. Dead, and safely buried, past hope of resurrection, under a mountain of debts.

SPITZEE GOLD MINES, LTD. **BRITISH COLUMBIA.**

Reincorporated, August, 1905, as Spitzee Mining Co., Ltd.

SPITZEE MINING CO., LTD. **BRITISH COLUMBIA.**

Mine office: Phœnix, Yale district, B. C. Organized 1905, as successor of the Spitzee Gold Mines, Ltd., under laws of British Columbia, with capitalization $350,000, shares $5 par. Property produced, to September, 1905, circa 5,000 tons of ore, averaging $12 per ton in value, and was said, at that date, to have circa 30,000 tons of ore in sight. Management seems satisfactory and property is well regarded.

SPOKANE COPPER CO. **WASHINGTON.**

Letter returned unclaimed from former mine office, Cle Elum, Wash.

SPOKANE MINE. **WASHINGTON.**

Letter returned unclaimed from former mine office, Twisp, Wash.

SPONDULIX MINE. **COLORADO.**

Mine office: Granite, Chaffee Co., Colo. A. D. Bullis, owner. Has auriferous and argentiferous copper ores, opened by shaft.

SPRINGDALE COPPER MINING CO. **OREGON.**

Mine office: Athena, Umatilla Co., Ore. Idle.

SPRINGFIELD GOLD & COPPER MINING CO., LTD. **IDAHO.**

Office and mine: 720 Bank St., Wallace, Shoshone Co., Idaho. Wm. Lively, president; D. A. McKenzie, vice-president and manager; Jos. T. Whelan, secretary. Capitalization $100,000, shares 10 cents par. Lands, 4 patented claims, area 80 acres, well timbered, in the St. Joe district, showing 2 fissure veins, opened by about 1,100′ of tunnels, longest 860′, showing a 13′ vein of ore, carrying estimated values of $22 per ton. Presumably idle.

SPRINGFIELD-MEXICAN MINING CO. **MEXICO.**

Office: 213½ South Sixth St., Springfield, Ills. Mine office: Unión de Tula, Jalisco, Mexico. Employs 25 men. Geo. F. Stericker, president; Geo. M. Morgan, vice-president; Harvey C. McCann, secretary; Alfred Orendorff, treasurer; Gerald G. Hereford, superintendent; Arthur Hay, engineer. Organized June 3, 1903, under laws of Arizona, with capitalization $500,000, shares $1 par; issued, $425,000. Annual meeting, third Tuesday in May.

Lands, 25 pertenencias, area 62 acres, in the Ayutla district, including the Concepción group of 16 pertenencias, 6 miles south of Ayutla, showing 3 veins, of 4′ average width, with circa 1,000′ of workings. The various properties of the company show 7 veins, reported as fissures in porphyry, of 7′ average width, carrying malachite, azurite, bornite and chalcopyrite giving average assays of 7% copper and 12 oz. silver per ton. Development is by shafts of 220′, 58′, 86′, 25′, 100′ and 175′, and by 8 tunnels, 2 longest 258′ and 340′, with a total of 582′ of underground workings, estimated to show 10,000 tons of ore blocked out for stoping. Property is an antigua, closed 1821 and reopened 1903. Equipment includes a 30-h. p. steam plant and 6 mine buildings. Nearest railroad is the Mexican Central, 40 miles distant. Company has shipped a little high-grade ore, in 10-ton lots, for mill tests, to the National Metal Co., at Ameca and Guadalajara. Management plans continuous development and the erection of a concentrator.

SPRINGFIELD MINE. **MARYLAND.**

An old and idle property in Carroll county, Maryland.

SPRING GULCH GOLD MINING CO. **COLORADO.**

Mine office: Idaho Springs, Clear Creek Co., Colo. J. B. MacFarlane, superintendent, at last accounts. Property is the Banty group, carrying auriferous and cupriferous silver-lead ores. Has gasoline power.

STADTBERGER HÜTTE ACTIEN GESELLSCHAFT. **GERMANY.**

Office: care of Otto Meurer, president, Köln, Germany. Mine office: Nieder Marsberg, Westfalen, Germany. Obersteiger Speiss, manager. Employs circa 450 men. Capitalization, 2,250,000 marks. Was known formerly as Stadtberger Gewerkschaft, working since A. D. 1150. Has 3 mines, the Minna and Friederike, active, and the Oscar, idle. Plant includes concentrator and smelter. New deep shafts are being sunk at all three of the mines. Production averages circa 45,000 metric tons yearly, of ores giving average returns of 1.8% copper. Production, 1905, was 1,609,358 lbs. fine copper.

STANDARD CONSOLIDATED COPPER CO. **ARIZONA.**

Office: 43-52 Wall St., New York. Mine office: Clifton, Graham Co., Ariz. John K. Erskine, president; M. Gould, secretary and treasurer; preceding officers and Geo. Frazer, directors. Organized 1903, under laws of Maine, with capitalization $1,500,000, shares $10 par. Is a holding company, controlling various subsidiary corporations through stock ownership. Shareholdings include $292,515 capital stock of the Standard Copper Mines; 140,000 shares of the capital stock of the Clifton Copper Mines, Ltd., and 26,107 shares of the capital stock of the Coronado Copper Mining Co., control of latter being held by the Shannon Copper Co. The Standard Consolidated Copper Co. also owns the San José mine, and the Los Angeles group.

Lands owned and controlled by the company are all more or less contiguous, lying on both sides of Chase creek, for 1½ miles, on the line of the Coronado railroad, 5 to 6 miles north of Clifton.

The Standard mine, 5 claims, area 99 acres, is extensively developed by open-cast workings, with about one mile of underground openings, on a vein of 2′ to 4′ width, carrying very rich ores, ranging from 16.5% to 51% in copper tenor, with an actual smelter average of probably about 20%

The Coronado group, 7 claims, adjoins the Standard and is supposed to carry a continuation of the Standard ore body.

The San José group, 3 claims, area 48 acres, is one mile east of Metcalf, lying west of the Standard group, and south of the King mine of the Arizona Copper Co., showing a 4′ to 5′ vein of chalcocite, slightly developed, giving high assay values.

The Los Angeles group, 4 claims, area 80 acres, is near Morenci, and circa 2 miles from the San José group.

The Copper Center group, 8 claims, partly patented, has been but slightly developed.

Ore is carried from the Standard mine to the Coronado railroad by a

Leschen aerial tram, of 3,200′ length, with a drop of 800′, operated by gravity, which transports ore at a cost of circa 5 cents per ton, as against the former cost of $2 per ton, when shipped by burros. The tram-line has shipping-bins at the lower terminus, on the railroad tracks. Mine equipment consists of a gasoline hoist.

Mr. C. A. Ross, the former president, was arrested on charges of larceny and embezzlement, being accused of confiscating the books of the company, but was exonerated, upon trial. There has been considerable quarreling among the officers of the company, by reason of which its affairs have not been handled to the best advantage, and there seems to be some ground for the charge that dividends were paid before the property was sufficiently developed to warrant such disbursements.

Ore formerly was sent to the Shannon smelter, but, with a change of management, ore is sent, beginning 1906, to the Detroit smelter. Production, 1905, was 1,088,952 lbs. fine copper and 2,620 oz. fine silver, of which 31,853 lbs. copper came from San José mine, and 37,517 lbs. copper came from the Clifton mine. This property is considered meritorious, and it is hoped that under the new management good progress may be made.

STANDARD CONSOLIDATED MINES CO. **OREGON.**

Office: Sumpter, Ore. Mine office: John Day, Grant Co., Ore. Zoath C. Hauser, president; H. H. Nicholson, manager; Edw. W. Mueller, secretary; C. B. Wade, treasurer. Organized May, 1903, under laws of Arizona, with capitalization $5,000,000, shares $1 par. Lands, 26 claims, area circa 500 acres, on both sides of Dixie Creek, in the Quartzburg district, with about one mile of workings, showing auriferous and cupriferous cobalt-nickel ores. Is said to plan building a 50-ton concentrator.

STANDARD COPPER CO. **ARIZONA.**

Mine office: Casa Grande, Pinal county, Arizona. Lands, 7 claims, 13 miles from Casa Grande. Idle.

STANDARD COPPER CO. OF ARIZONA. **ARIZONA.**

Office: 520 Chamber of Commerce, St. Louis, Mo.

STANDARD COPPER MINES. **ARIZONA.**

Office: 52 Wall St., New York. Mine office: Clifton, Graham Co., Ariz. Organized February 21, 1901, under laws of Arizona, with capitalization $500,000, shares $1 par; issued, $425,000. Is controlled by the Standard Consolidated Copper Co., through ownership by latter of $292,515 of issued stock. Paid dividends, to end of 1905, of $69,500. Lands, 99 acres. Buildings include an engine-house, office, laboratory, smithy, boarding-house, stables, etc.

STANDARD COPPER MINING CO. **WYOMING.**

Office: P. O. Box 22, Toledo, Ohio. Mine office: Encampment, Carbon Co., Wyo. Geo. P. Waldorf, president; Alphonse Monnell, vice-president; Joseph M. Spencer, secretary and treasurer, preceding officers Fred O. Paddock, Walter D. Guilbert Peter Parker, Charles E. Winter, Harvey M. Cook and Wm. S. MacKenzie, directors; William L. Sills, superintendent. Organized August, 1903, under laws of Wyoming, with capitalization $1,500,000,

shares $1 par; issued, $1,150,000. Annual meeting, first Tuesday in August. Lands, 6 claims, area 120 acres, known as the Susquehanna group, about ½ mile east of the Itmay group. Country rocks are diorite, quartzite, schist and granite, carrying sundry fissure and contact veins of 10′ estimated average width, opened by shafts of 55′ and 207′, with a total of about 400′ of workings, showing malachite, azurite, chalcocite, bornite and chalcopyrite, giving assays of 18% copper and $2 gold per ton. Equipment includes a hoist, good for 600′, and 5 buildings. Idle since December 15, 1905, but company plans resumption during 1906.

STANDARD GOLD & COPPER MINING CO. **OREGON.**

Absorbed, 1903, by Standard Consolidated Mines Co.

STANDARD MINING CO. **CALIFORNIA.**

Mine office: Cima, San Bernardino Co., Cal. Lands, sundry claims, 11 miles from Cima, on the Salt Lake Railroad, and 15 miles from Ivanpah, opened by a 200′ shaft, showing carbonate ore near surface, with melaconite and sulphides on the 100′ level. Carload shipments have sampled 10.5% copper, 3 oz. silver and $1.20 gold per ton, ores being taken from the dump. Company planned beginning shipments of 10 tons daily, early in 1906.

STANDARD MINING & REDUCTION CO. **MONTANA.**

Office and mine: 109 East Broadway, Butte, Silver Bow Co., Mont. John H. Lynch, president; C. W. Siglar, vice-president; D. C. Campbell, secretary and treasurer; preceding officers, G. D. Beveridge, C. J. Fellows, F C. Geiger and C. Woltjen, directors. Organized 1905, under laws of District of Columbia, with capitalization $1,000,000, shares $1 par. Lands, 5 claims, in the Fleecer Mountain district, circa 25 miles southwest of Butte, 5 miles from the railroad station at Divide, with a good wagon road between, slightly developed by 2 shallow shafts, showing ores giving good assay values in copper. Idle at last accounts.

STANLEY BUTTE MINING CO. **ARIZONA.**

Mine office: San Carlos, Gila Co., Ariz. James E. Carpenter, general manager; Harry Pryor, superintendent; Lands, 60 claims, held under bond and lease, opened by a 125′ tunnel.

STAR CONSOLIDATED MINING CO. **UTAH.**

Office: 6 Atlas Blk., Salt Lake City, Utah. Mine office: Eureka, Juab Co., Utah. Has auriferous and argentiferous copper ores, with steam equipment, and employed circa 25 men, at last accounts.

STAR COPPER MINING CO. **MICHIGAN.**

Office: care of John C. Watson, 68 Devonshire St., Boston, Mass. F. H. Raymond, president; C. O. Burbank, secretary and treasurer. Lands, circa 760 acres, in Sections 9, 10 and 16, Town 58 North, Range 28 West, Keweenaw county, Michigan. Has 2 shafts, deepest 300′, on a fissure vein, south of the greenstone, sunk 1851-1857, when company expended circa $70,000. Since idle.

STARLIGHT MINE. **ARIZONA.**

Owned by Tri-Bullion Smelting & Development Co.

STARLUS COPPER & GOLD MINING CO.

Letter returned unclaimed from former office, Chicago, Ills.

STATE LINE COPPER MINING CO. **WYOMING.**

Reorganized, circa 1904, as State Line Mining Co.

STATE LINE MINING CO. **WYOMING.**

Office: 300 Century Bldg., Denver, Colo. Mine office: Encampment, Carbon Co., Wyo. D. W. Aupperle, president; Hon. S. M. Elwood, vice-president; W. W. Wemott, secretary and treasurer. Organized circa 1904, with capitalization $1,500,000, shares $1 par, as a reconstruction of the State Line Copper Mining Co Lands, 17 claims, area 340 acres, on State Line Hill, in the Encampment district of Wyoming, near the Colorado line, showing a 3′ vein of ore, giving assays of 21% copper, from 17 pits and shallow shafts of 10′ to 60′ depth. Company has started a crosscut tunnel and apparently is in controversy with an adjoining company, over titles.

STAUFFER CHEMICAL CO. **CALIFORNIA.**

Office: San Francisco, Cal. Lands, 80 acres, known as the Alma mine, near Oakland, Alameda Co., Cal., developed mainly by tunnels. Ore is cupriferous iron pyrites, ranging from 1.5% to 3.5% copper, up to 50% sulphur and up to $2.50 gold per ton, occurring in lenses between serpentine and metamorphosed chert, in a belt traced 3,000′. After burning for sulphur the cinder is leached for copper. Presumably idle.

STEAMBOAT MINING CO. **UTAH.**

Mine office: Brighton, Salt Lake Co., Utah. Presumably idle.

STEMP SPRINGS COAL & POWER CO. **WYOMING.**

Works office: Copperton, Carbon Co., Wyo. Is said to plan building a 250-ton smelter, to treat ores of the Anchoria Copper Co. and other properties of that district.

STEMWINDER MINE. **BRITISH COLUMBIA.**

Owned by Dominion Copper Co., Ltd.

STEPHENSON-BENNETT CONSOLIDATED MINING CO. **NEW MEXICO.**

Mine office: Organ, Donna Ana Co., N. M. J. J. McCullough, general manager. Lands, sundry claims, in the Organ Mountains, opened by a 2-compartment shaft on a vein carrying argentiferous copper and lead ores. Has steam power, hoist, air-compressor and a 50-ton concentrator.

STEPTOE MINING CO. **NEVADA.**

Property sold, Sept. 4, 1902, to New York & Nevada Copper Co.

STERLING COPPER CO. **ARIZONA.**

Letter returned unclaimed from former office, 44 Broadway, New York. Lands were 12 claims, in Graham county, Arizona.

STEVENS COPPER CO **ARIZONA.**

Office: care of Fred Enos, secretary Bridgeport, Conn. Mine office: Clifton, Graham Co., Ariz. Employs circa 30 men. Henry Setzer, president; Chas. D. Hawley, vice-president; Frederic S. Hunt, treasurer, Chas. E. Stevens, superintendent; F. A. Alsdorf, consulting engineer. Lands, 39 claims, area 780 acres, circa 2 miles from Metcalf. Country rocks are granite, overlaid by Cambrian quartzite and Silurian limestone, with much

ulting, and intrusive porphyrite dykes, ores occurring near the fault-lines. Early in 1906 was shipping ore, running 12% to 30% copper, to the Shannon smelter. Property considered promising.

STEVENS PEAK COPPER MINING CO. **IDAHO.**

Apparently out of business, and presumably dead.

STEWART GROUP. **WASHINGTON.**

Sundry claims, in Ferry county, Washington, circa one mile south of the international boundary line, supposed to have been bonded, 1905, for $50,000, to Hon. Johnathan Bourne, of Portland, Oregon.

STILLAGUAMISH & SULTAN MINING CO. **WASHINGTON.**

Office: 606 Bailey Bldg., Seattle, Wash. Letter returned unclaimed from former mine office, Silverton, Snohomish Co., Wash. Richard Sykes, president; J. W. Clise, vice-president and general manager; Willis B. Herr, secretary. Organized September 22, 1892, under laws of Washington, with capitalization $3,000,000, shares $50 par. Lands, 15 claims, area 575 acres, in the Stillaguamish district, with 1,400′ of mine openings, showing low-grade auriferous copper ore. Idle for several years.

STILLMAN COPPER MINING CO. **WYOMING.**

Office: 408-145 La Salle St., Chicago, Ills. Lands supposedly are in the Encampment district of Carbon county, Wyoming. Idle.

STOBIE MINING CO. **ONTARIO.**

Mine office: Desbarats, Algoma, Ont. James Stobie, president; A. B. Upton, vice-president and general manager; John Lear, secretary and treasurer. Organized 1900, under laws of Ontario, with capitalization $1,000,000, shares $1 par. Lands, 134 acres, in Block O, Johnson township, Algoma, Ontario showing a vein of 3′ to 5′ width, carrying chalcocite, bornite and chalcopyrite. A carload of ore, shipped 1901, gave smelter returns of 18% copper. Idle since circa 1901.

STOCKTON COPPER MINING CO. **CALIFORNIA.**

Lands, sundry claims, in the Burney Valley, near Pitt river, Shasta county, California, said to show auriferous copper ores. Idle.

STOCKTON COPPER MINING CO. **COLORADO.**

Office: 312 Bank of Commerce Bldg., Minneapolis, Minn. Mine office: Salida, Chaffee Co., Colo. C. T. Bergh, president; J. W. Allan, secretary; A. E. Chilson, manager, Webster, S. D. Development is by a 225′ tunnel, giving a fair showing of carbonate ore, with occasional native copper. Presumably idle.

STOCKTON COPPER MINING CO. **MONTANA.**

Letters returned unclaimed from former office, Butte, Mont., and former mine office, Radersburgh, Broadwater Co., Mont. E. W. Harney, president; P. A. Gamer, secretary; John Rathfus, superintendent. Organized under laws of Montana, with capitalization $1,000,000. Lands include the Idaho claims, in East Butte, and the North Star group, in Broadwater county, the latter having been a limited producer in the past. Property is considered of value, but company suffers from acute financial debility.

STODDARD COPPER CO. **ARIZONA.**

Mine office: Stoddard, Yavapai Co., Ariz. Robt. J. Campbell, president; John N. Drake, secretary; Isaac T. Stoddard, general manager; John Martin, superintendent. Organized under laws of Arizona, with capitalization $5,000,000, shares $5 par. Lands, 16 claims, including the Binghamton mine, some distance from a railroad, opened by shafts, deepest 250′ in the Copper Bottom mine, also various tunnels, longest 1,000′. Has secured returns of $15 to $26.50 per ton, from smelter shipments. Has a concentrator, Huntington mill and 50-ton smelter, on the Agua Fria river. Good carbonate and oxide surface ores near surface were succeeded by a leached zone, but fair grade sulphide ores have been secured at depth. Property considered promising, but idle, at end of 1905, from lack of funds, though management hoped to resume work on a considerable scale, during 1906.

STONE CREEK COPPER MINING & MILLING CO. **MONTANA.**

Letter returned unclaimed from former office, 818-109 Randolph St., Chicago, Ills. Mine office: Dillon, Beaverhead Co., Mont. G. J. M. Porter, president; B. J. Soper, secretary; A. L. Stone, agent. Organized 1901, under laws of Arizona, with capitalization $1,250,000, shares $1 par. Lands, 8 claims, area 125 acres, in the Stone Creek district, showing malachite, azurite and low-grade copper outcrops. Has a 60′ two compartment main shaft and 5 shallow pits, also a 130′ tunnel. Idle for several years.

STONE HILL COPPER MINES. **ALABAMA.**

An idle property, once worked extensively, in Cleburne county, Alabama.

STONEWALL COPPER CO. **ARIZONA.**

A swindle, perpetrated by the notorious Wm. F. Wernse gang, of St. Louis.

STORA KOPPARBERG BERSLAGS AKTIEBOLAG. **SWEDEN.**

Office, mines and works: Falun, Dalarne, Sweden. Capitalization, 9,600,000 kroner, shares 1,000 kroner par. E. J. Ljungberg, director; Lars Yngström, assistant director and general manager; Th. Witt, mining engineer; K. A. Akerblom, superintendent of leaching plant. Lands, 5 claims, 3 patented and 2 unpatented, area 43 hectares. Mine was worked as early as A. D. 1288, and presumably earlier, oldest privileges of the present company dating from Feb. 24, 1347. Company conducts extensive industrial operations, owning and operating iron and steel plants, a paper mill, pulp-mill, sawmill, etc., in addition to its copper mines and smelters. Has several mines and many ore bodies, largest being the Storrgrufa, 370 metres long by 220 metres wide, and about 320 metres deep, mostly mined out, leaving an open pit of circa 220′ depth. Ore is chalcopyrite, containing selenium and bismuth, giving average returns of 2.7% to 3% copper, 10 grams to 15 grams silver and 2.5 grams to 3 grams gold per ton. Has 14 shafts, with aggregate depth of 1,800 metres, deepest being 343 metres, with about 33 kilometres of tunnels. Has water power. The copper mine employs about 100 men, and gives a yearly production of about 45,000 tons of raw ore, which, after hand-cobbing, yields about 15,000 tons of leaching ore. The roast stalls are one-half kilometre from the mine, and the leaching plant is one-half kilometre beyond the fur- naces, all connected by tram-line.

The roasted ore is crushed with salt, re-roasted and leached with dilute sulphuric acid, in tanks, the metallic contents of the leach-water being precipitated on scrap iron, as cement copper, which is dissolved in sulphuric acid and turned out as bluestone. Yearly production averages circa 300 kgs. silver, 80 kgs. gold and 1,250 metric tons bluestone, equivalent to 300 tons fine copper.

STORRGRUFA MINE. **SWEDEN.**

Owned by Stora Kopparberg Berslags Aktiebolag.

STRATHCONA MINE. **ONTARIO.**

Office: care of J. F. Black, owner, Sudbury, Algoma, Ont. Lands, in Levack township, slightly developed, show copper-nickel sulphides. Idle.

STRATTON GOLD & COPPER MINING & MILLING CO. **COLORADO.**

Organized 1905. Lands, 170 acres, well timbered and watered, in Chaffee and Fremont counties, Colorado, said to be opened by a 200′ shaft, showing an 8′ vein. giving good assays in copper.

STRICKLEY-MONTEZUMA MINING CO. **UTAH.**

Mine office: Bingham Canyon, Salt Lake Co., Utah. W. J. Strickley, superintendent. Has auriferous copper ores, and steam power. Idle.

STRONG COPPER CLAIMS CO. **OREGON.**

Lands sold, circa 1901, to Waldo Smelting & Mining Co.

STRONG COPPER MINING CO. **WYOMING.**

Office: 210 Grant Ave., Laramie, Wyo. Mine office: Leslie, Albany Co., Wyo. Employs 25 men. N. E. Corthell, president; E. P. Baker, vice-president and superintendent; I. R. Swigart, secretary, treasurer and general manager. Organized January 12, 1903, under laws of Wyoming, with capitalization $1,000,000, shares $1 par. Annual meeting, first Wednesday in January. Lands, 16 claims, area 270 acres, in Section 4, Town 16, Range 71, Albany county, Wyoming, showing a fissure vein in pegmatite, and contact veins between granite and limestone, of which one, with average width of 7′, gives average assays of 4% copper, 3 oz. silver and $3.60 gold per ton, with some lead and molybdenite, from malachite, chalcocite,bornite, chalcopyrite, galena and wulfenite. Mine is opened by about 20 shallow pits and a 335′ shaft, and by a 450′ tunnel, with 935′ of underground openings, estimated to show 10,000 tons of ore. Has a 25-h. p. steam hoist, and plans building a 25-ton concentrator.

DAVID A. STUART. **PERÚ.**

Office and mine: Quicachaca, Yauyos, Perú. Was a small producer of copper, silver, lead and coal, at last accounts.

SUCCESS COPPER MINING CO. **ARIZONA.**

Office: 536 Douglas Bldg., Los Angeles, Cal. Letter returned unclaimed from former mine office, Quartzite, Yuma Co., Ariz. Chas. E. Eichelberger, president; Robert Marsh, secretary and treasurer. Organized 1902, under laws of Arizona, with capitalization $750,000, shares $1 par. Lands, 6 claims, area 124 acres, in the Plomosa district, showing 5 contact veins, 2, of 12′ average width, carrying oxide and carbonate ores, giving average assays of 15% copper, 40 oz. silver and $3 gold per ton. Has shafts of 60′, 75′, 115′, and 250′,

also a 300′ tunnel, with 1,700′ of underground openings. Has steam power and planned installing a 50-ton smelter, but failed to do so.

SUGAR LOAF MINING CO. **SOUTH DAKOTA.**

Office: care of Drake, Barnes & Co., Cleveland, Ohio. Letter returned unclaimed from former mine office, Custer, Custer Co., S. D. Property was the Richard Palmer mine, which shipped a little low-grade auriferous copper ore, for flux, to the Deadwood smelter, circa 1903.

SUGAR PINE MINE. **OREGON.**

Office and mine: care of G. N. Bolt, owner, Galice, Josephine Co., Ore. Ores carry gold, silver, copper and lead. Has water and gasoline power, and a 4-stamp mill. Presumably idle.

SULITELMA AKTIEBOLAG. **NORWAY.**

Office and works office: Helsingborg, Malmöhus Län, Sweden. Mine office: Sulitjelma, Nordland, Norway. Employs 1,700 men. Lord-Lieutenant G. Tornerhjelm, president; Consul Nils Persson, vice-president; C. Ingelsson, secretary; Emil Knudsen, general manager; preceding officers, August Sylvan, Thure Röing, R. M. B. Schjölberg, C. E. Hedström and Sture Person Henning, directors; Prof. Hjalmar Sjögren and C. Ingelsson, deputies; H. Holmsen, superintendent; Fredrik Carlson, mine superintendent; P. Kjölseth, mill superintendent; Hans Dyck, smelter superintendent; L. D. Jensen, engineer.

Organized 1890, under laws of Sweden, with capitalization 3,000,000 kroner, increased, 1906, to 6,000,000 kr., shares 500 kr. par. Paid an 8% dividend in 1905, amounting to 240,000 kr., and has paid total dividends, to end of 1905, of 1,800,000 kroner. Annual meeting, in May.

Lands, 291 claims, area 63 acres, also a 1¼-acre millsite and miscellaneous holdings, extensively mineralized, of 193.06 square miles, lying mainly north of the Arctic Circle, in the Skjerstad division of the Tromsö district of Norway, including the Sulitjelma, Carlotta, Geken and Altens groups of mines. The Sulitjelma mine, discovered 1875 and opened 1887, has become the principal copper mine of Norway.

Country rock at the Sulitjelma mine is mica-schist of lower Silurian age, with eruptive flows of greenstone conformable with schists, ore bodies occurring as extended lenses, very persistent in strike and depth, on the contact of the schists with metamorphosed amphibolite and olivine gabbro, lenses dipping from 10° to 45° with the horizon. Ore is exclusively cupriferous iron pyrites, averaging 2.25% copper and 45% sulphur, with small quantities of nickel and 0.5 oz. silver per ton. There are 16 known lenses on the company's lands, of which 9 are undergoing development, these averaging 15′ to 36′ width, and 450′ to 1,500′ known length.

Development is mainly by tunnel, there being one shaft of 280′ depth and 9 tunnels, the names and number of feet of workings of the latter, at the end of 1905, being as follows: Ny-Sulitelma, 8,940′; Hanka-Bakken, 1,640′; Giken, 15,800′; Carlotta, 11,100′; Måns-Petter, 2,450′; Bursi, 700′; Koch, 2,740′; Tornerhjelm, 3,000′; No. 9, 2,160′. The mine has total openings of 52,000′, showing 2,502,000 metric tons of ore, with 953,000 tons blocked out for stoping.

The mine has a 400-h. p. plant, the mill a 390-h. p. plant and the smelter a 560-h. p. plant. The various installations have an aggregate of 1,220 h. p in electric energy, 260 h. p. in hydraulic energy and 720 h. p. in pneumatic energy. The mines have 9 hoists, 1 Ingersoll-Sergeant, 1 Burchard and 3 Schramm air-compressors, with an aggregate capacity of 28 drills, and 25 power drills are used. The mine buildings are of wood, the machine shop having an area of 1,291 square feet, carpenter shop, 1,291 sq. ft., smithy, 1,722 sq. ft. There is an extensive system of aerial tramways, with 15 stations and 2 power stations. The company also owns 132 dwellings.

The concentrator, of wood, area 37,950 sq. ft., has 6 Blake crushers, 15 F. Krupp Grusonwerk centrifugal crushers, 89 Hartz jigs, 10 Lührig and Ferrari concentrators, 24 vanners and an Elmore oil concentration plant, the concentrator having a daily capacity of circa 1,000 tons.

The smelter, at Fagerlid, 2 to 5 miles from the various mines, receives ore therefrom by aerial trams, and has a daily capacity of 160 tons. Equipment includes one 50-ton water-jacket blast-furnace, two 50-ton pyritic smelting converters, of the Knudsen type, and one converter stand with 10 shells of the Manhes type, taking 7.5 metric ton charges each. Product of first fusion is a matte of 30% to 40% copper tenor, and final product is a 99.2% blister copper, sent to the Helsingborg Kopparverks Aktiebolog, at Helsingborg, Sweden, for refining. There also is a leaching plant, in connection with the Helsingborg works.

Miscellaneous enterprises of the Sulitelma include 2 sawmills, a general store, 2 schools, a church and a Good Templar's lodge. The transportation system includes 7 steamers, 2 tugs, 40 barges and a private railway system of 13 kilometres length, known as the Sulitjelmabanen, equipped with 3 locomotives and 120 freight cars.

Fuel consumption and costs were as follows, for 1905: 4,950 cords wood, at 7.63 kr. per cord; 5,580 metric tons bituminous coal at 17.4 kr.; 1,177 metric tons coke, at 30 kr.; also 4,950 gallons petroleum. Average mining costs are 7.86 kroner per metric ton, concentrating costs 2.59 kroner, smelting and converting 16.41 kroner, and cost of blister copper is about 650 kroner per metric ton. Ores are divided into two classes, the first grade, or smelting ore, carrying 4% to 8% copper, while the second grade, for export, carries 1.5% to 4% copper, and an average of 45% sulphur, 34% to 36% iron and 2% to 2.5% alumina. Average tenor of all ores is about 3% copper and 45% sulphur. Gross ore production is about 90,000 tons yearly, and, of the sulphur ore exported, about half is fines and half lumps, sent to Helsingborg, Riga, Antwerp, Ghent and various ports in Great Britain.

Production 1904, was 605.3 metric tons fine copper, also 2,532 metric tons fine copper contained in circa 90,000 tons of cupriferous pyrites exported to sulphur-burners. In 1905 the local production was 446.9 tons fine copper, from 10,479.3 tons ore smelted, in addition to the quantity contained in ore exported, giving a total output of 6,225,856 lbs. fine copper. For 1906 the company plans enlarging the concentrator, building a new machine shop and laboratory and enlarging and partially remodeling the smel-

SUNNYSIDE COPPER MINING CO. **WYOMING.**

Letter returned unclaimed from former mine office, Riverside, Wyo.

SUNRISE COPPER CO. **WYOMING.**

Mine office: Sunrise, Laramie Co., Wyo O. L. Vincent, president; H. P. Jarrad, secretary. Organized, September, 1902, under laws of Wyoming. Lands, about 11 miles from Sunrise, were worked originally for iron ore. The copper ores carry gold and silver values. Presumably idle.

SUNSET COPPER CO., LTD. **BRITISH COLUMBIA.**

Dead. Lands, in the Similkameen district, were lost.

SUNSET COPPER MINING CO. **WASHINGTON.**

Office: Colvin Bldg., Glens Falls, N. Y. Mine office: Index, Snohomish Co., Wash. Addison B. Colvin, president; Paris D. Russell, secretary and treasurer; Hon. John C. Denny, chairman executive committee; W. W. Black, general manager; Geo. C. Clark, superintendent. Organized 1897, under laws of Washington, with capitalization $3,000,000, shares $1 par. Lands, 35 claims, area 700 acres, including the Sunset group of 23 claims, and Mountain Side group of 7 claims, latter having circa 400′ of tunnels, also a 20-acre millsite and sundry water rights. Mine is very fully described in Volume IV, and seems at present under the financial management of W. H. Baldwin, of Glens Falls, N. Y., who sold shares in the swindling California & Nevada Mining Co., and later made restitution by alloting Sunset stock, at par, to parties who bought California & Nevada shares. Early in 1906, Sunset stock was being offered to the public for 75 cents, and to brokers at 25 cents, per share. Management is not favorably regarded.

SUNSET GROUP. **BRITISH COLUMBIA.**

A group of 7 patented claims, area 268 acres, at Brown's Bay, Discovery Passage, Vancouver Island, British Columbia, opened by tunnels of 35′, 122′, and 256′, showing 4 fissure veins, traversing an amygdaloidal diabase, carrying bornite and chalcopyrite, with quartz gangue, giving average assays of 8% copper, 2 oz. silver and $3 gold per ton. Idle for several years.

SUNSET MINE. **BRITISH COLUMBIA.**

Letter returned unclaimed from former mine office, Princeton, Similkameen district, B. C. At last accounts property was under bond to F. T. Underwood, of New York, and was being probed by a diamond drill.

SUPERIOR-ALTA MINING CO. **UTAH.**

Office: care of Walter L. Maas, secretary and manager, Salt Lake City, Utah. Letter returned unclaimed from former mine office, Alta, Salt Lake Co., Utah. A. J. Jacobson, president; L. A. Jeffs, vice-president. Capitalization $300,000, shares $1 par. Idle.

SUPERIOR COPPER CO. **ARIZONA.**

Office: 20 Broad St., New York. Letter returned unclaimed from former mine office, Tucson, Pima Co., Ariz. T. B. Mills, president; W. L. Mercer, secretary. Organized under the laws of Arizona, with capitalization $1,000,000, shares $1 par. Lands, 10 claims, area 200 acres, 26 miles south of Tucson, with a shallow shaft, showing ores said to give average assays of 6% copper and $5 to $18 gold per ton.

SUPERIOR COPPER CO. **MICHIGAN.**

Office and mine: Houghton, Houghton Co., Mich. Reginald C. Pryor, president; R. Skiff Shelden, vice-president; Courtney C. Douglass, secretary and treasurer; preceding officers, John H. Rice and Jas. P. Edwards, directors; James Biscombe, superintendent. Organized July 23, 1904, under laws of Michigan, with capitalization $2,500,000, shares $25 par; issued, $1,500,000. The Calumet & Hecla Mining Co. owns several thousand shares of stock in this company, and has enough remaining stock under option to give 51%, or a control of the capitalization, and is in charge of development. The option on the stock expired September 1, 1906, and was extended to December 31, 1906, under condition that the Calumet & Hecla buy certain stock outright, and double the expenditure on development, to circa $5,000 monthly.

Lands, 400 acres, in Section 15, Town 54 North, Range 34 West. The tract formerly joined diagonally on the northeast corner of the Baltic mine, but owing to a rearrangement between the Baltic and Section 16 mine of the Altantic, the present neighbors of the Superior are the Isle Royale to the north, undeveloped lands to the east and south, and Section 16 of the Atlantic to the west.

The Superior tract carries approximately 6,000′ of the strike of the Baltic lode, which has been exposed at three points, by trenches, cut at intervals of about 1,000′, the overburden being very light. The trenches show an amygdaloid of circa 40′ average width, carrying copper wherever cut, the bed showing extensive carbonate stains, due to weathering, with a little fine copper, near surface, succeeded at depth by heavier copper, as the formation grows more settled.

Development is by 2 shafts, of which No. 1, at the north, is sunk in the footwall, insuring solid ground, but necessitating opening the lode by short crosscuts, at each level. Owing to the great width of the bed, it is necessary to crosscut along the drifts, in order to determine the exact degree of mineralization throughout the lode, but, as a rule, the drifts are carried in approximately the center of the bed, giving a fair average of the values carried. The two upper north drifts in No. 1 shaft show a little copper only, but the south levels all show good ground, and the north drifts on the third and fourth levels make a good showing. The south drift, on the second level, has passed through a copper chute, carrying values equal to the best ground yet opened in the Baltic, or other developed mines on the Baltic lode. The fourth level was opened, in No. 1 shaft, July, 1906.

No. 2 shaft, circa 2,400′ south of No. 1, was started June, 1906, and was 100′ deep on Aug. 17. 1906. Values in the mine, as opened, are mainly in stamp-rock, with occasional heavy copper, and the rock is somewhat deceptive in appearance, much of what apparently is barren in metal showing good stamp-copper, when broken.

Equipment includes a new steam plant, installed 1906, with a hoist good for 1,500′, a 12-drill air-compressor, two 100-h. p. boilers, and a new engine-house and shafthouse. Management is good, and there is little question that the Superior will make a fine mine, of the same general class

as the Baltic, Trimountain and Champion, which are opened to the southward on the same amygdaloidal bed.

SUPERIOR COPPER CO., LTD. **ONTARIO.**

Office: Sault Ste Marie, Ont. Mine office: Superior Mine, via Algoma Central Ry., Algoma, Ont. Frank Perry, president; E. L. Fisher, vice-president; W. A. Madison, secretary and superintendent; George Kemp, treasurer; preceding officers, W. L. Martin, H. B. Hanger, J. A. Culbeck, W. H. Teare and Geo. W. Nicholson, directors. Organized September 13, 1901, under laws of Ontario, with capitalization $1,500,000, increased, 1903, to $2,000,000, shares $10 par; issued, $1,440,000. Lands, 8 crown-granted claims, area 680 acres, in an unorganized district of Algoma, showing 2 fissure veins, in country rocks of granite and green chloritic schists, with average strike of N. 43° W., and dip of 70° to the southwest. First vein averages 20′ in width, and second about 70′ width, these being traceable about 8,000′, with about 1,000′ uncovered on the smaller vein, and nearly a mile trenched on the larger vein. Development is by about 20 pits and trenches and by shafts of 100′, 154′, 100′, 40′, 100′, and 260′, with a total of 1,050′ of underground openings, estimated to show 500,000 tons of ore, with 134,000 tons blocked out for stoping. Ores are chalcopyrite, bornite and chalcocite, with quartz gangue, carrying estimated average values of 3% copper, 1 oz. silver and $2.50 gold per ton. Has a 120-h. p. steam plant, with 6-drill Ingersoll-Sergeant air-compressor, 5 power drills, 2 hoists, engine-house, smithy, changing-house, boarding-house and 7 dwellings. Considerable good ore has been stocked at the shafts. Idle since August, 1904. Property considered promising.

SUPERIOR COPPER & GOLD MINING CO.

Office: 64 East Second St., Salt Lake City, Utah.

SUPERIOR MINING CO. **NEW MEXICO.**

Letter returned unclaimed from former mine office, Cerillos, N. M.

SUPERIOR MINING CO. **WASHINGTON.**

Office: 1529 Tower Ave., West Superior, Wis. Letter returned unclaimed from former mine office, Berlin, King Co., Wash. J. P. Simon, president and treasurer; B. A. Baerlocher, secretary and superintendent. Organized 1902, under laws of Washington, with capitalization $2,000,000, shares $1 par. Lands, 4 claims, area 82 acres, in the Miller River district, opened by a 125′ tunnel, showing an 8′ fissure vein, carrying carbonate and sulphide copper ores, associated with galena, assaying 6% copper, 7 oz. silver and $1 to $30 gold per ton. Idle for several years.

SUPERIOR & PITTSBURG MINING CO. **ARIZONA.**

Office: Calumet, Mich. Mine office: Bisbee, Cochise Co., Ariz. Chas. Briggs, president; James Hoatson, vice-president; Thos. Hoatson, second vice-president; Louis W. Powell, third vice-president and general manager; Gordon R. Campbell, secretary; Peter Ruppe, treasurer; preceding officers, Thos. F. Cole, Geo. E. Tener, Chester A. Congdon and Chas. d'Autremont, Jr., directors; H. B. Paull, auditor. Organized circa June, 1906, under laws of Minnesota, with capitalization $20,000,000, shares $10 par par; issued,

$15,000,000, of which $14,000,000 was allotted to old shareholders of four companies absorbed, and $1,000,000 was sold for cash, at par, being allotted pro rata to shareholders of the Lake Superior & Pittsburg, Calumet & Pittsburg, Pittsburg & Duluth and Junction mining companies. While at present the Superior & Pittsburg is a securities holding company only, it is planned eventually to retire all stock of the four underlying subsidiary corporations, making the Superior & Pittsburg a direct operating company. The four corporations under control of the Superior & Pittsburg are described fully, under their respective titles.

SURE THING GOLD-COPPER MINING & SMELTING CO. **WASHINGTON.**

Succeeded, circa 1905, by Clipper Mining Co.

SUSQUEHANNA MINE. **WYOMING.**

Owned by Standard Copper Mining Co.

SWAKOPMUNDER MINEN-GESELLSCHAFT. **GERMAN SOUTHWEST AFRICA.**

Office: Schellingstrasse 4, Berlin, W9, Germany. Mine office: Corob, via Swakopmund, German Southwest Africa. Capitalization 36,000 marks. Property is sundry mineral concessions in German Southwest Africa, with several slightly developed prospects, showing copper. Idle.

SWANSEA MINING CO. **MEXICO.**

Property, at La Cananea, Sonora, Mexico, sold, September, 1905, to Ronquillo Copper Co.

SWEDEN COPPER CO. **WASHINGTON.**

Merged, circa 1903, in Mt. St. Helens Consolidated Mining Co.

SWINDLER MINE. **ARIZONA.**

Owned by Huron Gold Co.

SWISHELM DEVELOPMENT CO. **ARIZONA.**

Lands, 40 claims, in the Swishelm Mountains, Cochise county, Arizona. Idle.

SWISS GIRL MINING CO. **ARIZONA.**

Lands sold, circa 1901, to Baumann Copper Co.

SYLVANIA MINE. **NEVADA.**

Mine office: Bullion, Elko Co., Nev. Vein carries a 6′ paystreak, from which circa 1,000 tons have been shipped. Presumably idle.

SYNDICATE MINING, MILLING & SMELTING CO.

Office: Spokane, Wash. Lands, 3 claims, 1 mile from the Snake river, said to show an 18′ contact vein between limestone and granite, carrying bornite and chalcopyrite assaying 12% to 17% copper, with small gold and silver values, opened by a 55′ tunnel and sundry surface-cuts.

TABLAS-FINANA COPPER CO., LTD. **SPAIN.**

Voluntarily wound up, December, 1901.

TABLE MOUNTAIN COPPER CO. **ARIZONA.**

Letter returned unclaimed from former mine office, Kelvin, Pinal Co., Ariz. Is controlled by Arimex Consolidated Copper Co., through ownership of 85% of stock issue. Lands, 27 claims, in the Bunker Hill district. Property not regarded as especially promising.

Organized 1882, under laws of Michigan, with capitalization $1,500,000, shares $25 par. Began dividends 1888, and paid 39 dividends, aggregating $8,700,000, to end of 1905, and paid a $3 dividend Jan. 25, 1906. Annual meeting, first Thursday in May.

Official returns to the State of Michigan, as of date Jan. 1, 1905, disclose the following figures:

Amount of cash paid in on capital stock	$ 580,000.00
Amount paid in by conveyance of property	200,000.00
Entire amount invested in real estate	199,486.00
Amount of personal estate	1,892,511.06
Amount of floating debt	1,076,628.93

The following table gives comparative results for three calendar years:

	1903.	1904.	1905.
Tons rock stamped	657,920	642,320	750,120
Pounds mineral obtained	24,055,512	22,662,070	24,780,945
Pounds fine copper obtained	15,286,093	14,961,885	15,824,008
Pounds fine copper per ton stamped	23.2	23.3	21.1
Cost of mining and stamping, per ton	$ 2.32	$ 2.42	$ 2.39
Cost of stamping, per ton, cents	.2624	.2603	.2217
Cost per pound fine copper, cents	.1150	.1298	.1337

Lands, 1,120 acres, in Sections 10, 11, 14 and 15, Town 56 North, Range 33 West, also the Cliff mine, in Keweenaw county, a millsite on Torch Lake, and miscellaneous timber lands and other realty, giving total landed holdings of 8,640 acres. The Tamarack mine proper is opened on a tract of very irregular outline, bounded on all sides by lands of the Calumet & Hecla. The Tamarack is opened on the underlays of the Calumet conglomerate and Osceola amygdaloid beds. The mine was planned by the late Capt. John Daniell, who conceived the idea of opening the underlay of the conglomerate by a deep vertical shaft. Actual work of sinking No. 1 shaft was begun in 1882, and the conglomerate was cut in 1885, three and a half years later, at a depth only 10′ greater than the estimate of Capt. Daniell, made before the first sod was removed.

The mine is opened by five shafts. The South Tamarack includes shafts Nos. 1 and 2, the original openings, while Nos. 3 and 4 are known as the North Tamarack, and No. 5, the newest shaft, is about midway between the north and south workings.

No. 1 shaft, 3,409′ deep at the end of 1905, cuts the conglomerate at 2,270′, and also cuts the Osceola amygdaloid. In this shaft as in all others of the Tamarack, the various levels are reached by crosscuts from the shaft, except at the actual point of intersection, this applying to both the conglomerate and amygdaloidal beds. The normal productive capacity of No. 1 shaft is 400 tons daily, and the amygdaloid workings are showing an improvement. The shaft is considerably drawn, and needs retimbering. No. 1 has a powerful hoist, good for the life of the shaft.

No. 2 shaft, near No. 1, is 4,355′ deep. In deep vertical shafts an absolutely perpendicular line cannot be maintained permanently, where the superimposed strata incline at any considerable angle, as in the case of the Tamarack. Slipping that cannot be detected on surface will work havoc with the perpendicularity of a deep shaft, in the course of years. No. 2 shaft became so badly drawn, early in 1904, that cages could not be operated, and was rebuilt from top to bottom. It being manifestly impossible to make any shaft immune from drawing because of earth movements, a double-lined shaft was constructed. This has an outer and an inner lining, the inner braced against the outer with timbers of varying length. These braces can be shortened or replaced, from time to time, and No. 2 shaft, was built to last the lifetime of the mine, but the best laid plans of mice and men gang aft agley, and a mine fire that broke out in No. 2 shaft, early in January, 1906, greatly damaged the new timbering, as well as causing many months' idleness and a heavy loss in production. No. 2 has a powerful hoist, good for the depth to which it can be sunk on the Tamarack lands.

No. 3 shaft is nearly a mile north of No. 1, and was 5,139′ deep at the end of 1905, being the deepest on the globe, cutting the Calumet conglomerate at a vertical depth of 4,185′. The bed is 20′ to 25′ wide, but is irregular in values, and far from rich, though payable, normal production being about 1,000 tons daily. The surface equipment includes an Allis hoist, with double conical drum, of 13′ 6″ diameter at either end and 36′ 9″ diameter in the center. The cable winds over specially built-up runs of steel, affixed to the surface of the drum, which works in counterbalance. This hoist has raised a 10-ton load, vertically, at a speed of 55 miles per hour, and running at that rate the cage has been stopped in a distance of 75′. The shaft has a 60-h. p. fan, 10′ in diameter, with blades 3′ 6″ wide, capable of supplying 192,000 cubic feet of free air per minute, to the depth of the shaft, which not only ventilates the mine but also aids in reducing the temperature, which otherwise would be nearly 90° Fahrenheit, in the bottom levels. An auxiliary hoist, used for lowering and raising men and timber, is a Nordberg duplex, with 32x72″ cylinders, having a drum of 18′ 6″ diameter, with lathe-turned grooves for coiling the cable.

No. 4 shaft, 600′ northeast of No. 3, is 4,450′ in depth, and has not been deepened since bottomed, in 1895. Occasional good ground is opened, but the shaft as whole is poor. Underground connection is had with No. 3, giving ventilation, and safety to miners in case of accident. No. 4 is used exclusively for hoisting water, lowering and raising men, and for purposes of ventilation and safety. A new concrete lining was substituted for the old wooden timbering, through the overburden, in 1904.

No. 5 shaft, lying about 3,300′ southwest of No. 4, and about midway between the Old Tamarack and North Tamarack shafts, is the newest and largest shaft of the mine, and but little shallower than No. 3, being 5,086′ deep at the end of 1905. Sinking was begun Aug. 7, 1895, and the conglomerate was cut on Dec. 20, 1901, at a vertical depth of 4,662′, the late Capt. Wm. E. Parnall having foretold the depth within 12′, and the time required within 11 days,

when the work was begun, 6 years before. The shaft is 7x29′, inside measurement, with 5 compartments in a row. The three central compartments, 5′x7 2″ each, are used for cages. One of the end compartments, also used for a cage, is 7′ 2″x5′ 4″, the extra 4″ being allowed for timber strain, while on the other side of the shaft is a compartment 3′x7′ 2″ for ladders, pipes and wires. The 10x14″ wall-plates of this shaft are 29′ 2″ long and the 5x7″ runners, serving as guides for the cages, are 16′ to 22′ in length. Instead of lag-screws being countersunk, the runners have a central groove, 2″ wide and 1½″ deep, running from top to bottom on both sides of each of the four hoisting compartments, these grooves providing for the escape of loosened lag-screws, without damage to cages or runners. The shaft openings have automatic covers that lift for passage of the cages. In sinking this shaft, 83 separate strata of trap, amygdaloid and conglomerate rocks, all barren, were cut, before the Calumet conglomerate was reached. Drifts have been opened both north and south, on the 31st to 38th levels inclusive, the northern drifts showing poor ground, with some improvement to the south. The north drifts on the 35th, 36th and 37th levels have been carried to the Calumet & Hecla boundary. As a whole No. 5 shaft is decidedly low in grade, although the conglomerate is of good average width. Connection has been secured underground with Nos. 1 and 2 shafts, and will be secured, eventually, with Nos. 3 and 4.

Surface equipment at No. 5 is the most extensive found at any shaft of the mine. The engine-house, boiler-house and compressor buildings are of redstone, with steel truss roofs. The engine-house has two duplicate 6,500-h. p. Nordberg hoists, each with four 36″ high-pressure cylinders having 72″ stroke. The drums are 24′ in diameter in the center, tapering to 16′ at the ends, each half carrying 6,500′ of 1½″ steel cable, the hoists operating in counterbalance and being capable of raising from a depth of 6,000′ a net load of 6 tons of rock, this having a gross weight, with cage and cable, of about 12 tons. The hoists cost $60,000 and $90,000 respectively. The boiler-house has six 200-h. p. Burt boilers with 84″ shells, and two 115′ brick-lined self-supporting steel smokestacks. Coal is delivered to the boiler-room from a railroad trestle.

The 50x75′ redstone compressor building at No. 5 has a 35-drill Ingersoll-Sergeant two-stage cross-compound air-compressor, with 18″ and 34″ steam cylinders and 36″ stroke, and a 100-drill triple-expansion Nordberg compressor with 19x53x48″ steam cylinders, and two-stage air cylinders of 18x27x48″.

The shafthouse and rockhouse at No. 5, built by the Wisconsin Bridge & Iron Co., at a cost of nearly $100,000, are on separate foundations and are separately framed and braced, although apparently standing as one building, 56x120′ on the ground, with an extreme height of 131′. The foundations are exceptionally massive, and the girders and framing are of unusual strength, to withstand the great strains caused by hoisting heavy cages, and the operation of powerful rock-breaking machinery. These buildings required about 700 tons of steel and 100 tons of corrugated iron siding in construction. Although 10 carloads of lumber were used in the building, no wood is exposed, except in the floors, asbestos sheathing-paper being used elsewhere to protect the wood, thus rendering the building practically fireproof. The rockhouse

has 3 Portage Lake crushers of the reciprocating jaw type, with room for 5 more when needed. Miscellaneous buildings at No. 5 shaft include a stone dry and smithy. An extensive timber yard was completed at No. 5, in 1905, on ground filled and graded for the purpose, the site having been a swamp, originally.

Water for steaming purposes and domestic use is pumped from Lake Superior, against a head of nearly 700′. The pumping station, nearly 5 miles northwest of the mine, has a Nordberg duplex pump, capable of raising nearly 1,500,000 gallons daily. Water is taken from a 40′ well on the lake-shore, connected with a tunnel driven 480′ under the bed of the lake, with about 35′ of water above the intake. Water is delivered into two steel tanks, of 42′ and 65′ diameter, on the highest point of the Tamarack mine location, these having a combined storage capacity of 200,000 gallons, water being distributed into mains from these standpipes. The pumping plant has developed remarkable efficiency, cost of operation being only about $10 per diem, including fuel and wages.

The Tamarack mine location is extensive, with a large number of dwellings for employes. The company owns and operates a hospital, 60x60′ in size, with two full stories, basement and attic. The basement and first floor are of selected Lake Superior redstone, upper story and attic of frame, with interior finish of selected quarter-sawed Georgia pine. The building has emergency wards, operating room, dispensary, sun-veranda, elevators and indirect steam heating.

The Tamarack owns the old Cliff mine, in Keweenaw county, the oldest mine in the Lake Superior district, which paid dividends of $2,518,620 from 1849 to 1879, inclusive. The mine was opened on a fissure vein, which was worked out, and the property abandoned in 1878. Diamond drilling was done on this tract during 1903, 1904 and 1905, the cores locating two cupriferous amygdaloids, one of which is supposed to be the northern extension of the Kearsarge lode, but apparently nothing of marked promise has been found by the drills, as yet. The old waste-burrows, which are extensive, have been leased, on royalty, to Henry Warren, who is building a mill with 8 gravity stamps, to treat the tailings.

The Tamarack has two stamp-mills, located on Torch Lake, a little more than a mile south of the Calumet & Hecla mills. The mills have 7 stamps, with an aggregate daily capacity of 3,200 tons of conglomerate rock. The heads have been fitted with eight-inch motar-grates, opening into quarter-inch-mesh revolving screens having Parnall-Krause hydraulic discharges. Finisher jigs have been replaced by Wilfley tables and Nordberg crushing rolls were installed, 1904, to care for the raggings from the stamp-mortars. These rolls have rigid journals, and each set has an independent wash.

No. 1 mill has Allis heads. Three of the 5 heads have been compounded, 2 single-stage heads being held in reserve. In the boiler-house at No. 1 mill four old boilers have been replaced by four 200-h. p. Pratt boilers, built for 200 lbs. steam pressure, but operated at a pressure of 150 lbs. per sq. inch.

No. 2 mill has two steeple-compound Allis-Chalmers stamps, and a 40′ addition has been built to the mill to provide the extra wash-room required by the increased stamping capacity of the heads. The 5 compounded heads are equal in capacity to the 7 single-stage heads formerly used, and are equal, at present, to treating the full normal production of the mine. No. 2 mill has a traveling crane, and No. 2 boiler-house has seven 200-h. p. boilers.

The Tamarack and Osceola mills have a joint pump-house, equipped with one 15,000,000-gallon pump and two pumps of 40,000,000 gallons daily capacity each, giving a total pumping capacity of 95,000,000 gallons per diem, practically 4,000,000 gallons per hour. The second large pump went into commission July 5, 1906.

Miscellaneous improvements at the millsite include a considerable number of dwellings for employes, and various subsidiary shops. A new machine-shop, of sand-lime brick, with steel roof, is 30x90′ in size, and finely equipped.

The joint wharves and steel coal-sheds of the Tamarack and Osceola, at Dollar Bay, on Portage Lake, are among the most extensive in the Lake Superior district.

Smelting is done at Dollar Bay, in the works of Lake Superior Smelting Co., controlled by the Tamarack, Osceola and Isle Royale companies, which have the same general management. All mineral is taken from mills to furnaces in hopper-cars, saving the former cost of barreling.

The Tamarack always has been an expensive mine to work, and the costs have increased of late years, unavoidably. Deeper openings mean greater costs in opening the ground, longer trams through crosscuts, heavier hoisting and pumping charges and increased danger in operation. Last, but by no means least, deeper workings mean lessened copper values. The management is devoting much thought and effort to the property, and in good years the Tamarack should earn substantial profits. Unfortunately the 1906 production will be much lessened, and profits greatly reduced, by the serious fire in No. 2 shaft, which cost a half-year's production from the South Tamarack, the richest part of the mine, and which will cut the year's output of metal to the lowest figures known for many years.

MINA TAMAYA. **CHILE.**

An idle mine, once important, 65 miles from Coquimbo, Chile.

TAM O'SHANTER MINE. **NEVADA.**

Mine office: Sandy, Lincoln Co., Nev. J. R. Newberry, owner. Idle.

TANGANYIKA CONCESSIONS, LTD. RHODESIA & CONGO FREE STATE.

Offices: 31, Clements Lane, London, E. C., Eng. Tyndale White, chairman; Robt. Williams, managing director; Geo. Grey, manager in Africa; R. M. Irwin, mine manager; C. R. Adams, resident engineer and mine superintendent; John R. Farrell, consulting engineer; L. Scotland, secretary. Organized Jan. 20, 1899, with capitalization £525,000, shares £1 par; issued £362,580. Company has bonds and shares in the Benguella and Katanga railway companies, owning 40% of the £40,000 capitalization of the Katanga Railway Co.

Lands, 2,000 square miles, north of the Kafue and Zambesi rivers, in Katanga district, Rhodesia, near the Congo Free State boundary, also 00 acres for railroad and steamship terminals, at the southern end of Lake ganyika, and a concession to explore extensive areas in the Congo Free te for 5 years, ended Dec. 31, 1905, and to work any discovered mine for years, with option of extending period of working to 99 years. In the go Free State 72 large mining concessions have been located, and company imates that 5 of these claims show 15,000,000 long tons of 10% copper e, most of which can be won by quarrying, and on another group company imates 1,500,000 tons of 13% copper ore. The Congo properties, in the anga district, are in a rolling country, with a healthy climate.

The principal copper mines of the company, in various stages of develop-nt, are the Kansanshi, Kambobe, Kabalela, Kakanda, Likasye and Fun-rume. Principal developments are on the Kansanshi, said to have a 16′ ure vein, with north and south strike, which has been worked open-cast, natives, for centuries, the mine showing trenches and pits for a distance of out 6,000′, these varying in width from 1′ to 75′ and in length from a few t to 1,200′, with extreme depth of 50′ in the deepest pit. Country rock is dstone, in places micaceous and fissile, and in other soft and clayey, through rtial decomposition, the sandstone being more or less charged with mala-ite, occuring as speiss. In the upper portions the vein matter carries achite and chrysocolla, with occasional occurrences of azurite and mel-nite, but in the deeper portions has chalcocite and chalcopyrite, associated ith iron pyrites, and carries occasional cuprite, the gangue being silicious, ith considerable manganese dioxide in the superficial portions. The fer-ginous matter in the gangue is chiefly limonite, usually somewhat ochrous, t occasionally hard and compact. The outcrops are mainly malachite, nd are stated by Mr. Farrell to show no evidence of having resulted from leration of sulphides in place, the evidence leading Mr. Farrell to the opinion hat the malachite was deposited from hot solutions, coursing in fissures. ive shafts have been sunk in old trenches, showing veins of 1′ to 16′ width, nd ore is stated by Mr. Farrell to average 15% copper, at a depth of 100′, ainly from malachite, with traces of sulphides. Ore carries an excess of bout 35% silica, and will require heavy fluxing, for which purpose iron ore nd limestone in abundance are not far distant.

The Fungurume mine has 4 short tunnels, one of which is stated to have enetrated 191′ of ore. The Likasye also is being opened by a tunnel. Prin-ipal developments, outside of the Kansanshi, are at the Kambobe No. 2, hich has two shafts, H and I, about 100′ deep each, with crosscuts said to xpose an ore body of nearly 300′ width.

The Ruwe gold mine shows an ore body of 9′ to 14′ width opened for quarter mile by 7 shallow shafts, deepest apparently being about 100′ only he vein apparently is a sandstone reef, likely to prove of considerable per-anence, and carries gold up to 9 oz. 7 dwts. per long ton. The ore [illegible] verage 5 dwts. gold and 9 dwts. platinum, with occasional [illegible]

gold being quite coarse. At the Ruwe is an alluvial gold deposit, estimated to contain circa 20,000 oz. gold, from which an average monthly production of £1,500 is secured, at a cost of only about 12s. per ounce.

The company also has stream-tin deposits, at Busanga, the payable alluvium ranging from 3′ to 10′ in thickness. Lode-tin deposits have been found at Kasonso and Chienzi.

The company owns and operates stores, and has a railway concession from the Portuguese government for construction of a line from Lobito Bay to Lake Tanganyika, which will require an expenditure of about £4,000,000. The climate near Tanganyika is said to be very good, for equatorial Africa, with an abundance of wood, and good water. The company has immense holdings, in districts difficult of access, and the work done has been distributed over such a large area that no great amount of development has been secured at any one point. Rail connections are absolutely necessary, for the making of payable mines of any considerable size, though the Ruwe placer mine is a highly profitable property, on a small scale. Some of the company's copper properties are decidedly promising.

TARBOX MINE. **MONTANA.**

Mine office: Saltese, Missoula Co., Mont. Is opened to depth of 500′, and has produced some ore of fair grade, from a 30′ vein, having a 12′ pay-streak of milling ore, balance being white quartz, carrying a little galena.

TARTANA, LTD. **AUSTRALIA.**

Offices: London Bank Chambers, Creek St., Brisbane, Queensland, Australia Mine office: Chillagoe, Queensland, Australia. H. M. Hicks, chairman; G. S Murphy, auditor; King & Rutledge, solicitors; J. B. Charlton, broker; E. Austin Bell, secretary. Organized under laws of Queensland, with capitalization £120,000, shares 5s. par. Lands, 230 acres, leasehold, on the Walsh river, circa 30 miles northwest of Chillagoe, showing large deposits of auriferous and argentiferous oxidized ores, below which considerable bodies of sulphides should be found. Has sent a little hand-picked ore, averaging 15% copper, to the Chillagoe smelter.

TASMAN-COMSTOCK CONSOLIDATED. **TASMANIA.**

Mine office: Queenstown, Montagu Co., Tasmania. A. Morley, manager. Lands, sundry claims, on the western slope of Mt. Lyell, slightly prospected. Employed 2 men, at last accounts, June, 1905.

TASMAN & CROWN LYELL EXTENDED MINING CORPORATION. (NO LIABILITY). **TASMANIA.**

Office: 47 Queen St., Melbourne, Australia. Mine office: North Mount Lyell, Montagu Co., Tasmania. Employs 10 men. Tom Agg Hills, chairman; preceding officer, Thos. White, A. F. Dean, W. F. Coleman and M. J. Jones, directors; John Branden, secretary; Edward Holehan, mine superintendent. Reorganized April 24, 1906, under laws of Victoria, with capitalization £37 500, shares 5s. par, of which 50,000 shares were issued to vendors and 100,000 shares were subscribed, 6d. paid in, giving a cash working capital of £1,500.

Lands, 3 claims, area 181 acres, in the North Mount Lyell district, developed by tunnels of 400′ and 1,453′, showing 2 ore bodies, carrying sulphide

ores of copper and lead, giving average assays of 7% copper and 15% lead. Company plans continuing development, on a small scale.

TASMANIA COPPER MINING & MILLING CO. **COLORADO.**

Office: 603 Provident Bldg., Philadelphia, Pa. Mine office: Winfield, Chaffee Co., Colo. D. B. Dance, vice-president; G. Albert Smyth, secretary: Edw. O. McHenry, treasurer. Organized April 20, 1898, under laws of Colorado, with capitalization $1,000,000, shares $1 par. Lands, 13 claims, area circa 250 acres, in the La Plata district, with about one half mile of underground openings, estimated to show 750,000 tons of auriferous and argentiferous galena, sphalerite and chalcopyrite. Has a pyritic smelter, of 20 to 40 tons daily capacity.

TASMANIAN COPPER CO., LTD. **TASMANIA & AUSTRALIA.**

Offices: 348, Winchester House, London, E. C., Eng., and Patterson St., Launceston, Tasmania. Mine offices: Rosebery, Montagu Co., Tasmania, and Blinman, South Australia. F. L. Cox, chairman; E. M. King, chairman local board; C. M. Henrie, general manager; J. G. Coldwells, secretary London office: A. Simon, secretary Tasmanian office. Organized Jan. 13, 1897, with capitalization £325,000, shares £1 par; issued, £317,069. Debentures, £12,500, at 10%, issued June, 1905, redeemable, 1915, at par, or earlier at 50% premium.

Tasmanian property includes the Rosebery and Ring River mines, area 386 acres, also a 5-acre smelter-site, in the West Coast district, showing a 24′ fissure vein, traceable about 3,000′, carrying 1% to 3% copper, 10 oz. silver and 3 dwts. gold per ton. Ore is zinciferous chalcopyrite, and owing to excess of zinc, at depth, no satisfactory method of reduction has been devised. Mine is developed by tunnels, longest 644′, with about 1,600′ of underground openings, and ore reserves are estimated by company at 158,400 tons.

The Blinman mine, in the Flinders Range of South Australia, 272 miles north of Adelaide, was bought 1902, and is proving somewhat uneven in values. The Blinman, opened 1862, reopened circa 1899, has a 450′ main shaft, and has produced considerable ore averaging 8% in copper tenor, as mined, concentrated to an average tenor of 23% copper, for shipment to smelters, in addition to which small quanities of hand-picked ores, of 30% to 40% tenor, have been shipped. District is arid and considerable trouble is experienced in the dry season, from inadequate water supply. Ore reserves at the Blinman, June, 1904, were estimated at 58,500 tons, with circa 20,000 tons of medium-grade ore on surface. Production, 1904, from 3 months operations, was 288 long tons of matte, of 52.25% copper tenor, made from 5,524 long tons of ore smelted, equal to 337,075 lbs. fine copper. The Rosebery is a small producer, and, at last accounts, the Blinman was under development.

TASMAN LYELL COPPER CO., LTD. **TASMANIA.**

Absorbed, March, 1903, by Lyell-Comstock Consolidated Copper Co., Ltd.

TATERI MINE. **JAPAN.**

Mine office: Nosakogawa-mura, Yoshino-gori, Yamato, Japan. A very small producer, making circa 40,000 lbs. fine copper yearly, at last accounts.

TAUNTON-NEW BEDFORD COPPER CO. **MASSACHUSETTS.**

Office and works: New Bedford, Mass. Henry M. Lovering, president; Clarence A. Cook, vice-president and agent; Henry F. Bassett, treasurer. Is a consolidation of the Taunton Mfg. Co., New Bedford Copper Co. and Revere Copper Co. Has extensive copper and brass rolling mills.

TAYLOR COPPER MINES CO., LTD. **ONTARIO.**

Office: care of Robt. H. Taylor, president, Sault Ste Marie, Mich. H. P. Taylor, secretary. Expended about $30,000 in exploratory work. Idle since circa 1903.

TECOLOTE COPPER CO. **NEW MEXICO.**

Mine office: Las Vegas, San Miguel Co., N. M. Has steam power and a concentrator. Idle at last accounts.

TECUMSEH COPPER CO. **MICHIGAN.**

Office: 15 Congress St., Boston, Mass. Mine office: Boston, Houghton Co., Mich. John C. Watson, president; Daniel L. Demmon, secretary and treasurer; Richard M. Edwards, superintendent; preceding officers, Frank N. Stackpole and Stephen R. Dow, directors. Organized circa 1880, under laws of Michigan, with capitalization $2,500,000, shares $25 par; issued, $1,498,975. Ended 1905 with cash on hand, $32,181.

Lands, 560 acres, in a very irregular tract, lying next south of the Osceola mine, carrying circa 400 acres of the underlay of the Kearsarge lode. The property has had considerable development, at different times, in the past. First work was done on the Calumet conglomerate, where a shaft was sunk circa 1,000′, but found no payable copper. The second era of activity, 1899-1902, included the sinking of a shaft of about 2,300′, on the Osceola amygdaloid, but this bed was found practically barren of copper, and work was abandoned November, 1902.

Work was begun May, 1905, to locate the Kearsarge lode, which was showing well a short distance to the northward. Diamond drill borings located the Kearsarge bed, and it was decided to sink 2 shafts thereon. Owing to the narrowness of the tract, the Tecumseh carrying circa 1,800′ only of the strike of the Kearsarge lode, shafts are located 1,000′ apart, and can be sunk to a depth of circa 4,000′ each, before reaching the boundary, being sunk diagonally on the plane of the lode. No. 1 shaft was cutting a plat for the 400′ level, in May, 1906. The lode, as opened, averages about 15′ width, and gives a promising showing of copper. Plats have been cut and 10′ drifts started, each way, on 4 levels. No. 1 shaft is 6x18′, with a hoist good for 1,000′, and will sink to considerable depth before drifting. No. 2 shaft, 1,000′ north of No. 1, was started August 30, 1905, and was about 50′ deep in May, 1906.

The showing made by the Tecumseh, on the Kearsarge lode, is decidedly promising, but additional lands are needed to make a mine of good size, and there should be a consolidation of the holdings of the Tecumseh and adjoining land-owners.

TEHAMA MINING CO. **CALIFORNIA.**

Office: care of C. J. Gooch, president, Red Bluff, Cal. Property is the Donkey mine, supposedly a continuation of the Afterthought mine of the

Great Western Gold Co., in Shasta county, California. Is said to show a considerable body of medium-grade ore. Idle for several years.

TELEPHONE-ANCHOR MINE. **WYOMING.**

Letter returned unclaimed from former mine office, Rambler, Wyo.

TELESFORO COPPER CO., LTD. **SPAIN.**

Offices: 70, Queen Victoria St., London, E. C., Eng. Mine office: Cortegana, Huelva, Spain. Vicente de la Jaille, chairman; T. Greenhill, secretary. Organized March 9, 1904, with capitalization £50,000, shares £1 par; issued £9,207. Lands are El Telesforo and La Segura mines, near Cortegana.

TELLER MINING & MILLING CO. **COLORADO.**

Mine office: Idaho Springs, Clear Creek Co., Colo. John Owen, manager, at last accounts. Ores carry gold, silver, lead and copper.

TEMPEST MINING & SMELTING CO. **OREGON.**

Letter returned unclaimed from former mine office, Alamo, Umatilla Co., Ore. Ores carry gold, silver and copper. Has electric power and a 20-ton smelter.

FUNDICIÓN TEMPLEMAN, LTD. **CHILE.**

Voluntarily liquidated, July, 1902.

TENDERFOOT MINING CO. **WYOMING.**

Mine office: Douglas, Converse Co., Wyo. W. F. Hamilton, president; B. J. Erwin, secretary and treasurer. Lands, 6 claims, having a 90′ shaft, showing ore averaging 4.5% copper. Has a 700′ steam hoist. Idle.

TENNESSEE COPPER CO. **TENNESSEE.**

Office: 11 Broadway, New York. Mine office: Copperhill, Polk Co., Tenn. Employs 1,000 men. J. Parke Channing, president; Frederick Lewisohn, vice-president; J. H. Susmann, treasurer; preceding officers constitute the executive committee; E. C. Westervelt, secretary; preceding officers, H. H. Rogers, A. C. Burrage, Walter Lewisohn, Philip L. Henry, Jas. Phillips, Jr., directors; Randolph Adams, general manager; B. B. Gottsberger, assistant manager; W. L. Stevens, smelter superintendent; John Edwards, mine superintendent. Organized Apr. 26, 1899, under laws of New Jersey, with capitalization, $5,000,000, shares $25 par. Debentures outstanding, $450,000, in $1,000, 20-year 5% bonds. Paid 5% dividends 1903, 1904 and 1905. Issued 25,000 shares of treasury stock, at par, for new equipment, in 1905, and ended the year with cash, accounts receivable and bills receivable, aggregating $729,472.43. Net profits for 1905 were $452,106.07. Annual meeting, last Thursday in February. Colonial Trust Co., New York, and State Street Trust Co., Boston, registrars; National City Bank, New York, and Old Colony Trust Co., Boston, transfer agents. Stock is listed on the Boston Stock Exchange and dealt in on the New York curb market.

Lands, 2,080 acres, also 11,000 acres miscellaneous lands, in the Ducktown district, showing 6 series of lenses, of which 3 are being developed. Ore occurs as lenses in ... veins, lenses averaging 30′ to 70′ width and 500′ to 2,000′ length, with an average depth of 400′. Ore is chalcopyrite, associated with iron pyrites, in a quartz gangue, carrying 2% to 4% copper, about 40% iron, 27% sulphur and 15% silica, with only traces of gold

and silver. Country rock is metamorphic mica-schist, of pre-Cambrian age, ore bodies showing extensive gossan cappings, and originally having a little oxidized ore near surface, which was mined out, long ago. As zinc and other refractory elements are lacking, the ore is excellently adapted to cheap and close concentration, and also smelts well, giving very clean slags.

Mines of the company include the Burra Burra, London, Tennessee, and Polk County, developed to depths of 300′ to 605′. These mines were opened circa 1850, and were operated regularly, previous to the American Civil War. The principal property is the Burra Burra, having a 605′ main shaft, sunk in the solid footwall, to guard against drawing, which was retimbered, 1905. This mine has about 8,000′ of underground workings, not including worked-out stopes. The lense is 30′ to 85′ in width, and is opened for a distance of 1,030′, on the third level. Production of the Burra Burra, 1905, was 131,654 tons of ore, with reserves of 2,225,000 tons in sight, at the end of the year.

The London mine has a lense of 25′ to 75′ width, 500′ in length on the first level, and has a 588′ shaft. Work was suspended at this property, 1904, but was resumed, 1905, with a production of 63,373 tons for the year, reserves of ore in sight being estimated at 445,000 tons.

The Polk County mine, opened by a 300′ shaft, has an ore body of 20′ to 90′ width, and of undetermined length and depth. Production, 1905, was 17,802 tons of ore, wth reserves of 315,000 tons.

Diamond drill borings show further ore, estimated at 1,070,000 tons, giving the mine total ore reserves exceeding 4,000,000 tons. The company also owns valuable iron lands, including the Eureka iron mine, operated, under lease, by the Virginia Iron, Coal & Coke Co.

The mines have a complete machinery plant, including water-tube boilers, Nordberg first-motion hoists, and a Nordberg cross-compound two-stage air-compressor. The shafthouses are a sort of cross between the rockhouses of the Lake Superior native copper mines and the concentrators of the copper ore mines, each equipped with a 100-h. p. compound engine, 18x31″ crushers, 42x144″ screens and 36″x33′ Robins conveying-belts, for hand-sorting, these shafthouses having a daily crushing and assorting capacity of about 2,000 tons, ore being reduced to 4″ size. The Burra Burra shafthouse is 127′ in height.

The smelter, at Isabella Junction, is a little north of the old Tennessee mine, and one to five miles from the other mines of the company. Ore is taken to the smelter over the company's 7½-mile standard-gauge private railroad, connecting with the Atlantic, Knoxville & Western line, and equipped with four 50-ton locomotives and 65 thirty-ton ore cars. The company owns about 60 dwellings for employes.

The smelting plant, designed and built by Mr. Channing, is admirably planned, material being handled throughout by gravity wherever possible. The smelter was greatly enlarged, during 1905 [illegible] formerly were three 56x188″ water-jacket blast-furnaces, and four new furnaces have been added, these being 56x270″ at the tuyeres, nearly trebling the smelting capacity of the plant. The furnace building is of steel, with large ore-bins,

d the charging floor is 18′ above the tuyeres, furnaces being charged from ton cars, drawn by electric locomotives. The plant includes six blowing gines, one being the largest ever built. This has a steam-end with three ass-compound cylinders, with a 15″ high-pressure cylinder and 32″ low-ressure cylinders, having a 42″ stroke, with 6 blowing cylinders, each 70″ n diameter, delivering blast at 3 lbs. pressure per square inch. The furnace uilding also has a 25-ton refining stack. Slag-pots are handled by electric locomotives, slag being used for railroad ballast. The converter department has 3 stands, with 15 shells, 84x126″, of the trough type, with a horizontal blowing engine for converter blast, and a 40-ton electric crane, which is to be duplicated.

The power-house at the smelter is of steel frame, with brick walls, enlarged during 1905, having 250-h. p. and 1,000-h. p. water-tube boilers, with a complete electric light plant.

The process of smelting has been changed radically, semi-pyritic smelting being substituted for the old method of preliminary roasting. The change has cut down production for two years, and has necessitated the enlargement of the reduction plant, but the first benefits were felt, 1905, in considerably reduced costs, and during 1906 the new system will begin giving its full benefits, in both reduced costs and enlarged production. The management hopes to smelt, during 1906, about 500,000 tons of ore, and make therefrom circa 18,000,000 lbs. fine copper, at a cost, not exceeding 7.5 cents per pound. In 1905, despite a limited output, total cost of blister copper, f. o. b. cars at the smelter, was only 8.08 cents per pound, a decrease of 1.1 cents per pound from the previous year, fully justifying the change made in the system of reduction. The extraction was only 34.82 lbs. per ton of ore smelted, making the cost only $2.81 per ton of ore treated, the items entering into this cost being, mining and hoisting, 68.6 cents; development, 17.1 cents; crushing and assorting, 10.6 cents, transportation, 12.8 cents, blast furnace smelting, $1.24; converting, 23.13 cents, and engineering, laboratory and miscellaneous, 20.8 cents. These figures speak eloquently of plant, system and management. Lower grade copper ores are treated elsewhere, at a profit, but in such cases there are gold and silver values to sweeten the product, which are lacking in the case of the Tennessee.

The product is shipped to Europe, as blister copper, electrolytic refining not being required, because there are no values in the precious metals worth saving, and no impurities of importance requiring elimination.

The smelter of the company is located in the extreme southeastern corner of the state of Tennessee, and the prevailing winds carry the bulk of the fumes into the state of Georgia. Suits brought against the company have resulted in permission by the federal court to postpone the action indefinitely, which is a victory for the company. The bull is to be taken by the horns, however, and an acid plant is to be built, during 1906. This will be one of the most important acid works in the United States, having a daily capacity of 400 tons of 60° Beaumé sulphuric acid. This plant will be designed and equipped on the same thorough and technically correct

lines as the other works of the company, and will make high-grade acid at very low cost. The location of the Tennessee plant is such, being readily reached from the more important phosphate fields of the south, that the manufacture of superphosphates should prove a highly remunerative industry, and though nothing has been said of the matter, it is probable that so wide-awake a management has not failed to canvass the situation.

Production, 1905, was 7,977,982 lbs. fine copper. Both production and the work of enlarging the smelting plant were hampered somewhat by a scarcity of labor—a trouble that is acute and threatens to become chronic in the south, owing to the marvelous industrial development now taking place in all of the southern states. Notwithstanding the minor drawbacks enumerated, the Tennessee made very substantial progress during 1905, and its successful future, under the present highly efficient and advanced management, is not open to question.

TERANO MINE. **JAPAN.**

Mine office: Saretani-mura, Iyo-gori, Iyo, Japan. Ore is chalcopyrite, associated with iron pyrites, carrying 4% to 5% copper. Vein, traversing chloritic schist, ranges up to 7′ width, with an average of 12″ to 24″ only. Production, 1898, was 25,974 lbs. fine copper.

MINA TESORE DE SONORA. **MEXICO.**

Mine office: Nacozari, Sonora, Mexico. Lands, sundry claims, south of Nacozari, near the Yaqui river, including the old Todos Santos, an antigua, which once had a smelter, as evidenced by a large slag-dump. Old workings were shallow, it being evident that only oxidized ores were mined and smelted. The property has been idle for a century or two, records being lacking. Ores have given assays up to 28.7% copper, 27.8% lead and 139 oz. silver per ton.

TETON COPPER MINING & SMELTING CO. **WYOMING.**

Letter returned unclaimed from former office, Jackson Hole, Wyo.

TEXADA COPPER MINING CO. **BRITISH COLUMBIA.**

Out of business. Fully described in Volume V.

TEXAS CONSOLIDATED MINE. **CALIFORNIA.**

Office: care of W. H. Garlick, owner, 438 East Ohio St., Marquette, Mich. Mine office: Redding, Shasta Co., Cal. Property is primarily a gold mine, and is said to have produced circa $1,000,000 values in 8 years, previous to 1904, under a former ownership, but is now idle, except for a little work by tributors. Property is said to carry undeveloped but promising copper veins. Has electric power and a 20-stamp mill. Ore production, by tributors, is sold to the Keswick smelter of the Mountain Copper Co., Ltd.

TEXAS CONSOLIDATED MINES & POWER CO. **CALIFORNIA.**

Dead. Property sold, circa 1904, to W. H. Garlick.

TEXAS COPPER CO. **TEXAS.**

Office: care of Glenn N. Congdon, Gowanda, N. Y. Organized July, 1902, under laws of New York, with capitalization $1,000,000. Lands sundry claims, in Texas, carrying indications of copper, salt and gypsum. Idle.

TEZIUTLÁN COPPER CO. **MEXICO.**

Organized under laws of New Jersey, with capitalization $1,000,000, shares $100 par. Is controlled, through ownership of stock, by the Teziutlán Copper Mining & Smelting Co.

TEZIUTLÁN COPPER MINING & SMELTING CO. **MEXICO.**

Office: 82 Beaver St., New York. Mine office: La Aurora, via Teziutlán, Puebla, Mexico. Employs 1,600 men. Geo. D. Barron, president; Robt. S. Towne, vice-president and treasurer; S. W. Reynolds, second vice-president; preceding officers, A. Foster Higgins, W J. Best, E. W. Gould, Jr., Henry L. Nelson, Henry Shepard and R. H. Carter, directors; E. Percy Smith, manager; C. J. Nourse, secretary and auditor; R. E. Safford, assistant secretary and treasurer; A. F. Schneider, mill superintendent; E. Du B. Lukis, engineer. Organized April, 1905, under laws of New Jersey, with capitalization $10,000,000, shares $100 par. Owns the entire capital stock of the Teziutlán Copper Co., and other properties, and has a close working connection with the Compañía Metalurgica Mexicana. Earnings of the old company were $794,013 in 1904, and dividends of the old company were $450,000 in 1904, and $578,326 in 1905. Dividends are to be paid quarterly, by the new company, at the rate of 6% per annum, beginning January, 1906. Annual meeting, first Thursday in June. State Street Trust Co., Boston, transfer agent.

Lands include the Aurora mine of the Teziutlán Copper Co., area 4,500 acres, also sundry other properties, giving total holdings of circa 7,000 acres of mining rights, with a 15-acre smeltersite and 400 acres miscellaneous lands, 10 miles from Teziutlán and about 130 miles east of the City of Mexico. Company is said also to have bought Los Ocotes mine, in 1906. The climate is equable, and the property is surrounded by fine arable lands. The labor supply is adequate, and of good character.

La Aurora mine is opened mainly by tunnels, and has developed a considerable body of auriferous and argentiferous chalcopyrite, associated with sphalerite, giving average assays of circa 8% copper, up to 200 grams silver and 5 grams gold per ton, with circa 15% iron, 20% sulphur, 10% calcium and 30% silica. The mine has an extensive surface plant, including a complete hydro-electric power installation, for which water is brought, by a 3,600′ flume, under a 900′ head, generating 1,000 h. p., which is transmitted electrically to the mine, about 6 kilometers from the power-plant.

The smelter, adjoining the mine, and receiving ore therefrom by aerial tram, has three 250-ton blast-furnaces, and the management plans adding another of the same size. Product is shipped as converter bars, averaging 98.6% copper. The mines and smelters are connected, by a 10-mile electric railway, with the Interoceanic Railroad of Mexico, at Teziutlán. Production, 1905, was 7,512,252 lbs. fine copper, 286.012 oz. fine silver and 3,057 oz. fine gold. The management is good, and this property seems the most successful and promising copper mine in Southern Mexico.

THARSIS SULPHUR & COPPER CO., LTD. **SPAIN.**

Offices: 136, West George St., Glasgow, Scotland. Mine office: Alosno, Huelva, Spain. Sir Charles Tennant, Bart., chairman; preceding officer,

lona, Spain. Property is the mina San Gervasio de Cassolas, showing a chalcopyrite ore body. Idle for some years.

TICON MINE. **MONTANA.**

Office and mine: care of James A. Murray, owner, Butte, Silver Bow Co., Mont. Lies east of the Speculator mine, and has a 500′ shaft, sunk on the pitch of the vein, showing about 4′ of good ore at the bottom.

TILT COVE COPPER CO., LTD. **NEWFOUNDLAND.**

Offices: 9, Queen St. Pl., London, E. C., Eng. Col. J. W. Young, chairman; E. C. Leaver, secretary; John Taylor & Sons, managers. Organized Apr. 4, 1888, with capitalization £200,000, shares £2 par: issued, £178,000. Freehold lands include the Tilt Cove mine, at Tilt Cove, Newfoundland, leased for 99 years to the Cape Copper Co., at an annual rental of £4,400, plus one-half of net profits earned, lease being terminable on a year's notice from the lessees. Dividends were 5.5% in 1903, 7.5% in 1904 and 7.5% in 1905.

TIMBER PEAK MINING CO. **NEW MEXICO.**

Mine office: Socorro, Socorro Co., N. M. Ores carry gold, silver and copper. Has steam power and a concentrator. Apparently moribund.

TINGEN MINE. **NORTH CAROLINA.**

An old and idle mine near Roxboro, Person county, North Carolina.

TINTIC COMPANY. **UTAH.**

Office: Salt Lake City, Utah. Organized 1903, under laws of Maine, with capitalization $3,000,000, shares $5 par, increased, 1906, to $4,000,000. Is the parent company of the Tintic Mining & Development Co., Yampa Smelting Co., and West Mountain Tramway Co., and is a securities-holding corporation only.

TINTIC MINING & DEVELOPMENT CO. **UTAH.**

Office: Salt Lake City, Utah. Mine office: Bingham Canyon, Salt Lake Co., Utah. Capt. Henry Stern, president; Geo. H. Robinson, general manager; W. J. Craig, superintendent; James W. Neill, consulting engineer and metallurgist. Organized 1896, with capitalization $3,000,000, shares $5 par, and reorganized January, 1906, under laws of Maine, with capitalization $3,500,000, shares $5 par. The 100,000 shares of new stock provided by the reorganization were underwritten at $7.50 per share, and money raised therefrom was used to liquidate a floating debt and to provide a reserve fund for working capital. Is subsidiary to the Tintic Company, and is managed as a close corporation.

Lands are sundry claims in the Tintic district, on which heavy expenditures have given indifferent results, and the Yampa group, area circa 180 acres, on Carr Fork, near the Utah Consolidated and Boston Consolidated mines, showing a vein of 10′ to 37′ width, carrying disseminated chalcocite, covellite and chalcopyrite, with an average tenor of 3.4% copper and from $2 to $5 combined gold and silver values per ton. Ores are highly ferruginous, making them valuable for fluxing the silicious ores of the Bingham district. The Yampa mine has upwards of two miles of underground workings, being developed by two tunnels and a 1,700′ shaft having 7 levels and connecting at the bottom with the Craig tunnel, through which ore is removed.

Craig tunnel is 3,248′ long, striking the main vein at about 2,200′ and coning at 2,448′ with the shaft. It is planned to install electric traction in the ig tunnel. The upper, or Yampa tunnel, intersects the shaft at 475′ and about 1,000′ on the vein, ore from the Yampa being sent down the shaft the Craig tunnel. Machinery plant includes 7-drill and 10-drill Rand compressors, and a hoist actuated by compressed air.

The smelter, at Yampa, is to be connected with the mine by a 2½-mile dal tramway, which will be the longest in the camp. This will be a very luable addition to the property, insuring prompt and economical handling a large and steady ore tonnage. The smelter has two 250-ton Allis-Chalmers ter-jacket blast-furnaces, 2 reverberatory furnaces and 12 McDougall asters, of which 1 reverberatory and 6 roasters were added March, 1906, ubly doubling the capacity of the works. The plant includes ore-bins, wer plant, blast-furnace building and calcining building. The main stack s an elevation of 287′ at the top from the tuyeres. It is probable that a verter plant will be added. Some trouble has been had with neighboring mers, who complain of damage from fumes.

At the end of 1905 the mine was producing circa 20,000 tons of ore month-; and production, 1905, was 4,069,886 lbs. fine copper. The Yampa has excellent management and is a valuable property, with prospects of beming a considerable producer, within the next few years.

NTO MINE. **AUSTRALIA.**

Mine office: Murrin Murrin, Western Australia. Has secured assays of 5% copper, 20 oz. silver and 1 oz. gold per ton. Presumably idle.

OCIEDAD LE LAS MINAS DE COBRE TINTO y SANTA ROSA. **SPAIN.**

Office: Rue Archimedes, 1, Brussels, Belgium. Mine office: Zalamea la eal, Huelva, Spain. Capitalization, 3,000,000 francs. Lands, 114 hectareas, cluding El Tinto, Santa Rosa and 9 other old mines. Has a 7-kilometre rial tram to Calañas. Property is leased to the United Alkali Co., Ltd.

IPTON COPPER CO. **NEW MEXICO.**

Letter returned unclaimed from former mine office, Tularosa, N. M.

IP TOP COPPER CO. **ARIZONA.**

Office: Commonwealth Bldg., Philadelphia, Pa. Western office: 7 Coles dk., El Paso, Texas. Mine office: Helvetia, Pima Co., Ariz. John Tarner, resident; S. Charles Pratt, vice-president and general manager; Geo. M. man, secretary and treasurer. Organized 1902, under laws of Arizona, with apitalization $1,150,000, shares $1 par. Lands, 24 claims, area 400 acres, cluding the Tip Top and Copper Duke claims, also a 100-acre millsite, in the lelvetia district, showing 3 contact veins, averaging 14′ width, giving average ssays of 5% copper and 1 oz. silver per ton, with a trace of gold, from carbonate and sulphide ores, opened by 7 shafts, of 10′ to 150′ depth, and several tunnels, longest 958′, with about 4,000′ of underground openings. Has gasoline power and has developed considerable ore. Presumably idle.

IP TOP COPPER CO. **NEW MEXICO.**

Office: 290 Third St., Milwaukee, Wis. Letter returned unclaimed from rmer mine office, Silver City, Grant Co., N. M. Capitalization, $2,000,000.

Dr. V. F. Mueller, president; P. T. McGrath, vice-president and general manager; Geo. W. Kliegel, secretary; Fritz Bock, treasurer. Lands, 4 claims, area circa 70 acres, lying near the Comanche and Burro Mountain groups, showing promising outcrops of both high and low grade ores, but apparently no work has been done on property, and company presumably is moribund.

TIP TOP MINE. **IDAHO.**

Office: care of J. Q. Packard, general manager, Worthington Bldg., Salt Lake City, Utah. Mine office: Doniphan, Blaine Co., Idaho. J. A. Lusk, superintendent, at last accounts. Lands, 12 patented claims, area 220 acres, in the Hailey district, developed by shafts of 500′ and 1,000′, with 7,000′ of underground openings. Has a complete steam plant, 20-stamp mill and 50-ton cyanide plant, working cupriferous gold ores.

TIP TOP MINE. **ONTARIO.**

Office: care of Col. S. W. Ray, Port Arthur, Ont. Mine office: Kashaboiwe, Rainy River district, Ontario. Employs 10 men. Richard Sandoe, superintendent. Was held formerly by the New York-Canadian Copper Co., Ltd.

Lands, 4 claims, being locations K62, K63, K64 and K65, area 336 acres, freehold, 6 miles from Kashaboiwe, on Round Lake, in Moss township, showing country rocks of schist and diorite, carrying 3 contact veins, ranging up to 150′ width, with 2 of 25′ average width, carrying circa 18′ of ore giving average assays of 7% copper, 5 oz. to 12 oz. silver and $1 to $2 gold per ton. Development is by shafts of 50′ and 208′, with 640′ of workings, estimated to show 35,000 tons of ore. Property has a 100-h. p. steam plant, including hoists of 10-h. p. and 30-h. p., and a 5-drill Ingersoll-Sergeant air-compressor. Property is considered promising.

COMPAÑIA MINERA DEL TIRO GENERAL, S. A. **MEXICO.**

Office: 2-a Ojcaliente No. 8, Aguascalientes, Mex. Mine office: Charcas, San Luis Potosí, Mexico. Employs 750 men. J. G. Creveling, Jr., president and general manager: W. F. Layer, vice-president; G. B. Wardman, secretary and treasurer; preceding officers, Thos. J. Ryder and O. F. Westlund, directors; DeWitt Creveling, superintendent; E. J. Cloyd, assistant superintendent; William Mueller, mine superintendent; Pablo Fuentes, engineer; W O. Staples, auditor. Organized July 31, 1902, under laws of Mexico, with capitalization $375,000, Mexican, shares $100 par. Dividends, 1905, were $150,000, Mexican, and $48,750 in the first quarter of 1906.

Lands, 71 pertenencias, area 176 acres, also 25 acres of millsites and a 50-acre farm, in the Charcas district. The mine shows 2 main systems, carrying fissure veins in eruptive prophyry, not far from a limestone contact, the North vein averaging 3 meters to 8 meters width, with a known length of circa 450 meters, developed for 350 meters length by shafts of 306m., 200m., 130m., 130m., 90m., 85m. and 55m., with upwards of 3,000 meters of workings on the North, or main vein, showing circa 200,000 metric tons of ore. The workings on the south zone are idle, awaiting the establishment of a concentrating plant adapted to this ore, which is of milling grade. The ore developed in the south zone is almost exclusively sulphide, and averages 2%

copper, 5% lead, 12% zinc, 430 grams silver and 0.8 grams gold per ton.

The mines were discovered circa A. D 1583, and were worked on a small scale for nearly 3 centuries, and on a larger scale since 1859. The property has a 340-h. p. steam plant for hoisting and pumping, and in addition makes some use of "malacates." Equipment includes 80-h. p. and 100-h. p. hoists and a Cameron station pump, and a 10-drill air-compressor has been ordered. A combination machine and carpenter shop, of stone, has been built, and a complete plant ordered therefor.

Tests have been made, in an experimental mill, on low grade ore, and a stone mill, with iron roof, has been built, and a 100-ton milling equipment ordered. As soon as the mill is tried out, and proven successful, it will be enlarged to 250 tons daily capacity. The mine has a large number of structures, for various uses, all built of stone, including a general store, etc.

The stockholders of this company own the Potosí Central railroad, of 15.1 kilometers length, running from the mine to Las Charcas station, on the Mexican National railroad.

Fuel is Laredo coal, costing $6.85, gold, per ton, delivered, and eastern coal, costing $8.40, gold, per metric ton, delivered. Production, 1905, was 2,281,761 lbs. fine copper, an increase of about 20% over the output of the previous year, and the 1906 production should be nearly 2,500,000 lbs. fine copper. Ore shipped, 1905, was 48,000 metric tons, ayeraging 2.16% copper, and production for first 3 months of 1906 was at the rate of 3,600 metric tons of shipping ore monthly, costing an average of $4 gold, per dry metric ton, f. o. b. cars of the Mexican National railway.

The company will sink the main shaft 230 metres, and is sinking a secondary main shaft, which should reach a depth of 150 meters by the end of 1906. Some exploring is being done, in new ground, both east and west of the present workings, with promising results, and the company plans installing a concentrator and making a considerable production of milling ore, during the year. The railroad equipment will be increased and a number of new buildings erected. All this work will be done from earnings, without reducing dividends. Company is a close corporation, with only 35 shareholders. The management is exceptionally good, and the property is one of proven merit, with an assured future.

TOKAR (SUDAN) PROSPECTING SYNDICATE, LTD. **SUDAN.**

Offices: 7, Devonshire Square, London, E. C., Eng. Sir F. Frankland, chairman; Felix F. Wilson, secretary. Organized December 2, 1904, with capitalization £5,000, shares £1 par. Property is a license, from the Sudan government, to prospect for minerals. Location of prospecting rights is approximately between 17° 30′ and 18° North Latitude, and between 37° 45′ and 38° 30′ East Longitude. Copper float is found over an area of circa 150 miles square, in a mountainous region near the Eyrthrean border, inhabited by the Hasas, a tribe of ebony Arabs. Country rocks are schist, having a strike of west of north, and a westerly dip, associated with eruptive crystalline rocks, showing numerous veins of low grade ore, apparently running about 2% copper only.

TOLEDO MINING & POWER CO. **MONTANA.**

Office: 108 La Salle St, Chicago, Ills. Mine office: Brandon, Madison Co., Mont. Louis D. McCall, president and general manager. Organized circa 1905, with capitalization $50,000, apparently as successor to Bismarck-Nugget Gulch Consolidated Mining Co., lands of which were sold, 1905, at sheriff's sale. Capitalization of the old company was $5,000,000 and capitalization of the new company is much nearer the actual value of the lands. Apparently the management is the same as that of the Bismarck-Nugget Gulch.

Lands, 17 copper claims and 18 gold claims, 3 groups of copper claims being on Stone Creek, in the Ruby Mountains. Property has a 60-ton concentrator and a 30-ton smelter. Mining operations are confined to the gold claims, but the copper claims are said to be promising.

SOCIÉTÉ ANONYME MINES METALIQUES DE TOLOSA. **SPAIN.**

Offices: Monceau les Mines, France. Mine office: Leiza, Navarra, Spain. Capitalization, 715,000 francs, in 1,430 shares. par 500 francs. Property comprises iron mines in Guipúzcoa, and lead-copper mines at Navarra, latter including the Regina and other mines, which were undergoing development, but were not arrived at a producing stage, at last accounts.

TOLTEC CONSOLIDATED MINE. **MICHIGAN.**

Office: care of Alfred Meads & Sons, Marquette, Mich. Lands, 320 acres, near Greenland, Ontonagon county, Michigan. Production, 1851-1860, was 206 tons, 1,443 lbs. fine copper.

TOLTEC MINING & SMELTING CO. **MEXICO.**

Office: care of A. W Cunningham, president, Waco, Texas. Mine office: Ayutla, Oaxaca, Mexico. Is said to have ordered machinery for a 100-ton concentrator, and to plan shipping concentrates to Teziutlán, Puebla, Mexico, for smelting.

TOMAHAWK COPPER & ZINC MINING CO. **ARKANSAS.**

Letter returned unclaimed from former office, 130 Broadway, New York. Chas. E. Welloone, president; R. A. Blair, secretary. Organized Nov. 16, 1899, under laws of Arizona, with capitalization $1,000,000. Lands include the Tomahawk copper mine, and sundry zinc claims, in Marion and Searcey counties, Arkansas. Presumably idle.

TOMOHAWK JUNIOR MINING CO. **MICHIGAN.**

Office: care of H. F. Fay. 60 State St., Boston, Mass.

TOM HAL MINING CO. **WASHINGTON.**

Mine office: Pateros, Okanogan Co., Wash. Thos. B. Warren, president and general manager. at last accounts. Lands, 5 claims, said to show a 4′ to 10′ vein, carrying auriferous and slightly argentiferous chalcopyrite, arsenopyrite and iron pyrites. Has steam power, and is a dead beat. Presumably idle.

TOM MOORE CONSOLIDATED MINING CO. **COLORADO.**

Mine office: Eureka, San Juan Co., Colo. S. G. Martin, superintendent, at last accounts. Ores carry gold, silver, lead and copper. Has water power.

TONOPAH-ALOHA MINING CO. **NEVADA.**

Office and mine: care of W. D. Nelligan, president, Tonopah, Nye Co., Nev. F. W. Johnson, secretary. Organized 1903, under laws of South Dakota, with capitalization $1,000,000, shares $1 par. Lands, 6 claims, in the Lone Mountain district, giving assays up to 12% copper and $60 gold per ton. Idle.

TONOPAH COPPER MINING & MILLING CO. **NEVADA.**

Office and mine: care of E. C. Day, secretary and treasurer, Tonopah, Nye Co., Nev. E. C. McDow, president; Herman Binnell, vice-president. Organized September, 1905, under laws of Arizona, with capitalization $2,000,000, shares 50 cents par. Lands, 5 claims, area circa 100 acres, in the Silver Star district of Esmeralda county, about 60 miles west of Tonopah. Company apparently was floated with the assistance of Letson Balliet, a well known promoter of crooked mining companies. Company is sending out 200-shares stock certificates, apparently at random, with request to recipients to pay $1 per month thereon, and comment seems unnecessary.

TONOPAH GOLD & COPPER MINING CO. **NEVADA.**

Offices: 16-32 State St., Rochester, N. Y., and P. O. Box 600, Spokane, Wash. Mine office: Tonopah, Nye Co., Nev. Edward Evans, president; Thos. R. L. Harris, secretary; J. W. Dunning, vice-president; F. A. Edgerton, assistant secretary; John Harris, superintendent. Organized under laws of Washington, with capitalization $1,000,000, shares $1 par. Lands, 4 claims, in the Samo district, formerly known as the Willow Springs camp, circa 40 miles west of Tonopah, opened by an 80′ tunnel, showing a quartz vein, carrying values in copper, silver and gold.

TONOPAH-UTAH MINE. **NEVADA.**

Mine office: care of J. L. Justice, manager, Tonopah, Nye Co., Nev. Has secured assays of 9% copper, 42 oz. silver and $6 gold per ton. Idle.

TOPEKA COPPER CO. **WYOMING.**

Office: 817 Kansas Ave., Topeka, Kans. Mine office: Holmes, Albany Co., Wyo. Employs 4 men. Wm. Benton, president; G. S. Simmons, vice-president; Ira N. Baker, secretary; H. E. Baker, treasurer; Avery T. Holmes, engineer. Organized March 23, 1906, under laws of Arizona, with capitalization $1,000,000, shares $1 par. Lands, 3 claims, area 60 acres, known as the Maudem mine, in the Lake Creek district, showing fissure veins in syenite and contact veins between syenite and limestone, carrying a little oxidized ore near surface, with sulphides at depth, in veins of 8′ width, giving assays of 12% copper, 9 oz. silver and $91 gold per ton. Development is by shafts of 30′ and 60′, and by tunnels of 100′ and 345′. Company plans continuing development and adding a light mining equipment.

TORCH LAKE MINING CO. **MICHIGAN.**

Office: care of Thatcher Loring, president, 3-19 Central St., Boston, Mass. Mine office: care of W. W. Stockley, Hancock, Houghton Co., Mich. Capitalization $500,000, shares $25 par. Lands, 1,280 acres, being Sections 35 and 36, Town 56 North, Range 33 East, lying east of the Tecumseh and midway

between Calumet and Lake Linden. Was slightly prospected, 1899-1900, by diamond drill borings, and since idle.

TORPEDO MINING CO. **NEW MEXICO.**

Office: 135 Adams St., Chicago, Ills. Mine office: Organ, Donna Ana Co., N. M. Geo. E. Wood, president; Harvey E. Rich, secretary; C. B. Rogers, superintendent. Lands, sundry claims, 16 miles west of Las Cruces, near the Copper Bar, opened to a depth of circa 500′, on a contact vein between limestone and granite, carrying lenticular ore bodies said to be increasing in size with depth. Property was opened circa 1876, and is said to have produced upwards of 4,000 tons of ore, averaging about 14% copper. Second class ore, averaging 6% copper, is being scrammed and shipped from the waste-dumps. Has steam power and a fair mining plant. Idle since 1903, owing to the inflow of circa 800 gallons of water per minute. Property is considered promising.

COMPAÑIA METALURGICA DE TORREON. **MEXICO.**

Office and works: Torreón, Chihuahua, Mexico. Ernest Madero, president; Carlos Gonzales, secretary; J. P. Pender, general manager; Donald R. Morgan, mine superintendent; E. Haines, smelter superintendent. Capitalization increased, 1905, to $5,000,000, Mexican, all issued, in $1,500,000 preferred 6% redeemable stock, and $3,500,000 common stock. Profit, 1904, was $629,279.50, Mexican, or 18% on the existing capitalization.

Lands are several promising lead mines and partly developed copper mines, including properties recently bought in the Santa Barbara section of the Parral district of Chihuahua. Company is said to haye leased La Fortuna mine, near Los Muertos station, on the Mexican International railroad.

The reduction plant includes a concentrator, lead and copper smelter and briquetting plant, with 8 furnaces of 1,000 tons daily capacity, which it is planned to increase circa 50% by installing 3 extra furnaces and a converter plant. Production, 1903, was 874,346 lbs. fine copper, and in 1904 the company treated 201,612 metric tons of ore. Company is said to have a concession, from the government of the state of Chihuahua, for building a reduction plant at Santa Barbara. The property is said to have been under option to the American Smelting & Refining Co., at $4,500,000, Mexican, but the option was not exercised, and the Torreón company refused to extend the same. This is one of the most important independent smelting plants in the republic, and is a well managed and successful property.

TOSTON COPPER COMPANY. **MONTANA.**

Office: Pennsylvania Bldg., Butte, Mont. Mine office: Toston, Broadwater Co., Mont. David J. Charles, president; Emil H. Renisch, vice-president; John A. Shelton, secretary; W. K. Edwards, general manager. Organized Dec. 24, 1903, under laws of Arizona, with capitalization $1,250,000, shares $5 par. Lands, 6 claims, area 120 acres, showing 3 fissure veins in porphyry, with a 200′ shaft in a vein of about 15′ average width, carrying chalcopyrite assaying 6% copper, 1 oz. silver and $2 gold per ton. Idle at last accounts.

TOTTENVILLE COPPER CO. **NEW YORK.**

Office and works: Tottenville, Staten Island, N. Y. Company manufactures copper and brass, in various forms.

TOWADA MINE. **JAPAN.**

Owned by Fujita-Kumi & Co.

TRAIL SMELTER. **CANADA.**

Described under title Canadian Smelting Works.

TRAINER MINE. **COLORADO.**

Mine office: Ascroft, Pitkin Co., Colo. Michael Hogan, owner. Has argentiferous lead and copper ores.

TRAMWAY MINE. **MONTANA.**

Described under title Snohomish and Tramway mines.

TRANSVAAL COPPER CO. **MEXICO.**

Office: 1408 Traction Bldg., Cincinnati, Ohio. Mine office: Cumpas, Moctezuma, Sonora, Mexico. Louis J. Hauck, president; R. A. Koehler, vice-president; J. M. Eilers, second vice-president; O. C. Rasch, secretary; Alfred Vogeler, treasurer; L. G. Cloud, consulting engineer; preceding officers, Louis Hehman and B. Freiberg, directors; Arthur W. Jenks, manager; Dr. A. Sandberg, smelter superintendent; James T. McDonald, mine superintendent; W. F. Neihart, cashier. Organized December, 1901, and reorganized July, 1903, under laws of West Virginia, with capitalization $6,200,000, shares $10 par; issued, $2,700,000.

Lands, 794 pertenencias, area 1,966 acres, also a 50-acre smelter-site and 25,000 acres of timber and grazing lands, in the Moctezuma district, showing 8 ore bodies, occurring as fissure veins and lenses, on which upwards of 16,000′ of development work have been secured. The Cobre Rico vein is opened by 2 shafts and 2 tunnels. Shaft No. 1, depth 200′, shows ore averaging 8% copper, 4 oz. silver and $1.50 gold per ton. Shaft No. 2, depth 140′, gives similar assays. Tunnel No. 1, length 135′, gives ores averaging 9% copper, 3 oz. silver and $1.50 gold per ton. Tunnel No. 2, length 600′, gives average assays of 4% copper, 3 oz. silver and $1.50 gold per ton. A large amount of ore has been exposed on this vein, which is very wide.

Transvaal No. 1 has 2 shafts and one tunnel. No. 1 shaft, 210′, is in ore. No. 2, the working shaft, is 318′ deep, with steam hoist, 2 Cameron pumps, two 80-h. p. boilers and a Sullivan air-compressor. Levels have been opened on the 300′ lift and considerable ore blocked out, this averaging 3% to 8% copper, 3 oz. to 4 oz. silver and $1 to $1.50 gold per ton.

The Buckeye mine, with about one-half mile of workings, has a vein ranging 18″ to 50″ in width, assaying 12% to 20% copper, 10 oz. to 35 oz. silver and $1.50 gold per ton, with 2,500 tons blocked out for stoping, at last accounts.

The San Nicolás has a 250′ shaft in a 4′ vein carrying silver-lead values averaging about $45 per ton, with about 3,000′ of openings and 6,000 tons blocked out for stoping. The mine has a steam hoist, two 80-h. p. boilers and a Sullivan air-compressor.

The Virginia gold mine carries a vein said to average 15′ width, with average values of about $12 per ton, in gold, developed by circa 1,000′ of workings.

The copper and silver-lead ore bodies occur as fissures, and also as wide mineralized dykes, in trachyte and rhyolite. Copper ores are mainly bornite and chalcopyrite, with occasional chalcocite, carrying the usual oxide and carbonate ores on the outcrops. The ore bodies of the Cobre Rico and Transvaal are mineralized dykes of apparently 200′ to 300′ width, carrying low-grade copper sulphides, associated with iron pyrites and having a quartzose gangue, hence liable to prove silicious and require heavy fluxing. The Cobre Rico and Transvaal No. 1 are estimated by the management to show about 2,500,000 tons of low-grade ore.

Improvements at the mine include an engine-house, boiler-house, shaft-house, office, laboratory, boarding-house, 22x90′ general store, and 6 dwellings. There also is a store at the smelter. Nearest railroad is the Nacozari line, 36 miles distant, but the Cananea, Rio Yaqui y Pacifico has surveyed a projected line into this district.

A 35-ton reverberatory furnace, at the Buckeye mine, was blown in, early in 1905, but was closed down, owing to unsatisfactory operation, and rebuilt, being blown in again, circa November, 1905, and is said to be doing satisfactory work, making matte carrying up to 65% copper, 55 oz. silver and $7 gold per ton.

The main smelter is at Cumpas, 15 to 20 miles from the mines, and it is planned eventually to build, at this point, reduction works having both lead and copper stacks, with daily capacity of circa 1,000 tons, to be connected with the mines by a narrow-gauge line that will traverse a rugged country, and will neither be easy nor cheap of construction. It was necessary that the mine smelter be located at Cumpas, where there is a good site and ample water supply. The plant includes a 150-ton water-jacket blast-furnace, 42x120″ at the tuyeres, and a 20-ton reverberatory furnace. Equipment includes a Connersville blower, three 80-h. p. boilers, and a tandem-compound engine, there being power and room for two additional 150-ton stacks in the blast-furnace building. The new smelter was blown in May 1, 1906, and is working matte averaging 40% copper, 100 oz. silver and 0.5 oz. gold per ton, from ores reported by the company to average about 10% copper. Product is shipped for refining to the Nichols Chemical Works, and the company does a general custom business, in addition to treating its own ores, having a small sampling mill and a custom ore department.

The management of the Transvaal company is composed of solid business men, who have their own money in the venture, and stock sales were discontinued early in 1905. The property gives promise of making a valuable mine, but the management doubtless will find that rail connections are required to render the property capable of treating the average of its ores at a profit.

TRANSVAAL COPPER CO., LTD. **TRANSVAAL.**

Offices: 109, Victoria St., London, S. W., Eng. J. B. Davis, secretary. Organized Aug. 15, 1899, with capitalization £150,000, shares £1 par., issued,

£1,225. Was formed to take over issued capital of the Subeni River (Transvaal) Mining Syndicate, Ltd. Inactive.

TRANSVAAL COPPER MINING CO., S. A. **MEXICO.**

Is the Mexican incorporation of the Transvaal Copper Co.

TRANSVAAL GROUP. **BRITISH COLUMBIA.**

Office: care of John M. Turnbull, lessee, Trail, B. C. Mine office: Ashcroft, Yale district, B. C. Lands, sundry claims, 18 miles southeast of Ashcroft, held under bond and lease, presumably in the interests of the Canadian Pacific railway.

COMPAGNIE DES MINES DE TRANSYLVANIE. **HUNGARY.**

Mine office: Brussels, Belgium. Organized 1903, with capitalization 2,000,000f., to develop mines of copper, lead, zinc, ochre, and coal, in Hungary.

GEWERKSCHAFT TRAUTENSTEIN. **GERMANY.**

Mine office: Benneckenstein in Harz, Braunschweig, Germany. A. Polednick, manager. Has 2 shafts, the Gertrude, of 36 metres, and the Silber-Marie, of 162 metres, developing ores carrying zinc, lead and copper. Employed circa 30 men, at last accounts.

TRAVERS CONSOLIDATED MINING CO. **MEXICO.**

Title changed, 1905, to Travers-Durkee Coppers.

TRAVERS-DURKEE COPPERS. **MEXICO.**

Office: 805 Rookery Bldg., Chicago, Ills. Mine office: Moctezuma, Sonora, Mexico. Employs 100 men. Richard P. Travers, president; Henry R. Durkee, secretary and treasurer; Thos. Travers, superintendent; W. Lorrain Cook, engineer; Dr. Franklin R. Carpenter, consulting metallurgist. Organized June 14, 1905, under laws of Arizona, as the Travers Consolidated Mining Co., with capitalization $6,000,000, increased, October, 1905, to $15,000,000, shares $10 par, and name changed, December, 1905, to present title. Annual meeting, third Tuesday in June.

Lands, 7 groups of claims, area 1,145 acres, in the Moctezuma district, 80 miles from nearest railway station, at Nacozari. Principal property is the Promontorio mine, in the Promontorio Mountains, circa 35 miles southeast of Moctezuma, near the Yaqui river. Country rocks are diorite, granite and limestone, showing sundry ore bodies, occuring in a large shear zone, between diorite and granite. One ore body, under development, is circa 300′ wide, on the tunnel level, 300′ below the crest, and is reported by the company to carry values of 20% copper for a width of 30′, 12.5% copper for a width of 60′, and 2.25% copper for the balance of 210′. Values in precious metals are given as 3 oz. silver and $4 gold per ton, in the high-grade ore and $1 silver per ton in the low-grade ore. The high-grade ore is chiefly bornite, and the lower grade is disseminated chalcopyrite. Company reports that 10′ of the ore in the 30′ paystreak will average above 40% copper, being massive bornite. Development is by a 125′ shaft and by tunnels of 175′ and 500′, with total underground workings of 1,125′, estimated by the company to show 360,000 tons of high-grade ore and 1,440,000 tons of low-grade ore, which seems excessive. Property is an antigua, and is said to have produced the copper from which were cast the bells on the old church at Moctezuma, built A. D. 1640.

During the American Civil War, some of the bornite was packed on mules, to Guaymas, 40 miles, and shipped to Swansea, for reduction.

Mine is developing without steam power, by tunnels, but the company plans utilizing a large available water power, on the Yaqui river. The company is shipping a little ore, in three grades, of 40%, 30% and 20% copper, all under 20% being held at the property, awaiting a smelter, which is being built 1½ miles from the mine. The smelter will have 150 tons daily capacity, presumably making matte, and will do custom smelting of gold and silver ores.

TRAVERSELLA MINES, LTD. **ITALY.**

Voluntarily wound up, December, 1902.

TRAVONA MINE. **MONTANA.**

Office and mine: care of Hon. W. A. Clark, owner, Butte, Silver Bow Co., Mont. Martin Buckley, superintendent. Is an old property, originally a silver mine, in the southeastern part of Butte.

GEORGE A. TREADWELL MINING CO. **ARIZONA.**

Office: 27 William St., New York. Mine office: Mayer, Yavapai Co., Ariz. Employs 35 men. Prof. Geo. A. Treadwell, president; Walter S. Logan, vice-president and treasurer; Miss Myra B. Martin, secretary; Walter S. Logan, treasurer; F. W. Wood, general manager; Frank W. Giroux, superintendent; A. J. McNulty, smelter superintendent; Geo. H. Kramer, engineer. Organized 1899, under laws of West Virginia, with capitalization, increased Jan. 21, 1905, to $3,500,000, shares $10 par. Controls the Brookshire Mining Co., through ownership of 80% of stock. Annual meeting, first Wednesday in February.

Lands, formerly reported as 102 patented claims, area 1,861 acres, are reported by company, April 10, 1906, as 60 patented claims, area 1,200 acres, also 180 acres of mill and smelter sites, in the Jerome, Big Bug, Peck and Agua Fria districts. Lands were supposed, 1905, to be held under a $200,000 bond and lease, partly paid. Mines are reported, 1906, as including the Brookshire, Hackberry, Boggs, Iron Queen and Cliff, and previously included also the Badger, Pastime, Crystal, Wallace and Agua Fria groups, some of which doubtless are yet held by the company.

Country rocks are Yavapai schists, magnesian slate and rhyolite, ore bodies occurring as replacements in the slate, following rhyolite intrusions. Formation has a generally east and west strike, with dip of 60° to 80° southward. Five ore bodies have been developed, to various extents, these averaging 5′ width and formerly being claimed by company to give average assays of 5% copper, 5 oz. silver, and $5 to $50 gold per ton, from chalcopyrite. Latest report, 1906, by company, gives average values, from bornite and chalcopyrite, of 3% copper, 10% zinc, 5 oz. silver and $2 gold per ton, which is much nearer the truth than the former claims, and probably is a very close approximation of the actual average value of the ore. Ores are said by the company to be self-fluxing.

The various mines of the company are developed by shafts of 485′, 350′, 375′ and 100′, and by tunnels and drifts of 7,700′ aggregate length. There also are numerous shallow shafts and short tunnels of an exploratory nature.

Principal development is on the Brookshire group, having upward of a half-mile of workings, showing considerable milling ore of 4% to 5% copper tenor, with fair gold and silver values. The Hackberry, deepest opening 500′, and quite wet, has nearly one-half mile of workings on an 8′ vein, and has two parallel veins, said to be of 9′ and 7′ width, latter claimed to carry ore averaging 10% copper and $10 gold per ton, which is an exaggeration. The Boggs, Cliff and Iron Queen mines all have considerable development. Mines as a whole are estimated by present management to show 80,000 tons of ore, with 40,000 tons blocked out for stoping, latter figure being a decrease of one-third from estimate of the previous year.

The mines have a 240-h. p. steam equipment, and the old smelters have 40-h. p. steam and 80-h. p. water plants, and the new smelter has a 160-h. p. steam plant. The mine has four 40-h. p. hoists, 12x14″, good for 500′ to 1,000′ each, and a 2-drill Knowles air-compressor, with 3 power drills. Shops include a 40x65′ wood machine-shop, 20x30′ smithy, office, boarding-house, bunk-house and dwellings, with a total of 40 buildings for various uses.

The concentrator, 75x100′, of wood, has two 24″ Dodge crushers, three centrifugal crushers and 2 concentrating tables, and is rated by the company at 200 tons daily capacity, utilizing a new method of dry concentration.

The company controls a private narrow-gauge railway line, known as the Hackberry & Iron Queen Railroad, circa 5 miles in length touching the Hackberry, Boggs and Queen mines, and connecting at Arizona City with the Sante Fé line, which reaches the new smelter, at Mayer. Equipment includes 2 locomotives and 9 cars.

Water is secured at Crystal Springs, 8 miles distant, and is delivered at the smelter through a 4″ pipeline, under a head of 1,150′, the water supply being good.

The company has three smelters, of which two are useless. The old Boggs, or Commercial smelter, has a calciner and two 40-ton water-jacket blast-furnaces. This is on the line of the narrow-gauge line, but is hopelessly antiquated in design and equipment, and was inherited from a preceding ownership.

A hydro-carbon smelter, designed to burn petroleum and to turn out blister copper from ore, by a single fusion, was built at Arizona City, by the company, under the advice of Prof. Treadwell, the president. This proved a flat failure, although the company advertised it as a great success, and sold considerable stock on the strength of its alleged "revolution" of existing processes of reduction. The hydro-carbon smelter is fully described in Vol. IV.

The third smelter, which is the second built by the company, is at Mayer. It was designed by Erwin D. Treadwell and is well planned and substantially constructed, embodying only features of proven worth. Mr. E. D. Treadwell, by the way, who was the only director of the company of whom any commendatory words could be said, seems to have severed his connection with the management, as he has been succeeded by a new general manager—a change upon which Mr. Treadwell is to be congratulated.

The new smelter, at Mayer, standing west of the old oil-smelter, has a 200-ton Mitchell economic hot-blast furnace, and a Connersville blower driven by an 18x22″ Erie engine. There are 2,500-ton storage-bins for ore, coke and limestone, with gates for loading into tram-cars for charging. Slag is granulated and washed out in launders. The old oil-smelter is to be remodeled into a reverberatory, and used for smelting flue-dust and concentrates. Product of new smelter, when working, is matte carrying 35% to 40% copper, 40 oz. to 60 oz. silver and 1.5 oz. to 2 oz. gold per ton, to be shipped for refining to the Aguascalientes plant of the American Smelting & Refining Co., which will be perhaps the first instance of American matte going to a Mexican refinery.

The company plans deepening the Hackberry shaft to 800′, reopening the Iron Queen mine and extending the workings in the Boggs.

Production, 1905, was 4,000 tons of ore smelted, giving copper, silver and gold values averaging $10 per ton. It is not likely that there will be any production during 1906.

For seven years the George A. Treadwell Mining Co. has been peddling its shares to widows, orphans and fools. For seven years its lying advertisements have promised impossibilities. For seven years this stock-jobbing corporation has paid out a large part of its income from stock-sales in advertising more shares for sale. These lying advertisements have been signed by Miss Myra B. Martin, but the other officers of the company are equally culpable, even though they may take refuge behind her petticoats.

To list the lies uttered by this putrid corporation would require pages of this volume. The company has lied about its mines, its ores, its smelters, its furnaces and its earnings. It has glorified Prof. Geo. A. Treadwell as the most eminent metallurgist of this or any other age, but how capable Prof. Treadwell is in this line was shown by his abortive hydro-carbon smelter. It has held him up, in the public prints, as the discoverer of the United Verde and the Greene Consolidated—brazen lies both. If the truth be in the company, or any of its directors, the fact has been most effectually concealed. The advertisements of the company always carry the same burden—just a little more stock for sale—buy it quick, and get rich.

The series of excuses put forth for several years are paltry prevarications. First the company needed just a few dollars to finish opening its mines—then a few dollars to complete a smelter—then a few more dollars to do more mining—then money to build another smelter, after which cash would flow in streams from the furnaces, the mines having immense ore reserves, merely awaiting the completion of the smelter—then, when the second smelter was built—just a few dollars to buy ore—then a few dollars more to open the mines. The second smelter is idle, the company's mines lacking ore to feed it, and apparently the company's excuse for asking cash to buy ore was just a blind to rake in a few more dollars. The mines are much lower in grade than claimed, and are inadequately developed.

The whole outfit should be jailed, for securing money under false pretenses.

ION MINING & DEVELOPMENT CO. **MONTANA.**

Office: 42 Broadway, New York. Mine office, Butte, Silver Bow Co., Employs 375 men. John D. Ryan, managing director; John Gillie, al superintendent; Geo. F. McGee, mine superintendent. Organized , under laws of New Jersey. Title changed, circa 1905, from Colorado ng & Smelting Co. Capitalization $2,500,000, entirely owned, except ders' shares, by the Amalgamated Copper Co.

Lands, 35 quartz and placer claims, mainly fractional, area 220 acres, uding the Gagnon and Otisco mines, in the western limits of the Butte per zone, ores being highly zinciferous and argentiferous. The Gagnon e has a 3-compartment shaft, 1,950′ deep, sunk at an angle of 74°, with ir shaft of 1,800′ depth 700′ to the westward. The Gagnon mine is timbered 1 square sets, using round timber, and shaft was partly retimbered, 1906. Mine has electric call-bells and is connected underground with the inal main shaft, the Gagnon shaft being only 150′ from the Original shaft, Gagnon carrying the continuation of the Original vein, and showing r good ore at the bottom.

The Gagnon mine has a 22x48″ Dickson hoist, with 1⅛″ round rope, ting two double-deck cages for men, changed for raising ore to two single- k cages with two 3-ton skips swung under. Miscellaneous equipment udes a 20-drill Rand air-compressor and 2 Aldrich electric pumps, with acity of 100 and 200 gallons per minute, respectively, working against a d of 1,000′.

The reduction plant, at Butte, has a concentrator and furnaces with) tons daily capacity, but lacks a converter. In addition to treating the gnon ores, this plant did a general custom business, until closed down. 4, since which time this company's ore is sent to the Butte & Boston plant, Butte, and to the Washoe works, at Anaconda. The old reduction plant is ng held in reserve, for emergency use. Daily production, February, 1906, s circa 550 tons of 3% copper ore, and production of 1905 is estimated at 500,000 lbs. fine copper.

NA TRES GRACIAS. **CHILE.**

Office and mine: Chañaral, Atacama, Chile. Basilio Caceres, owner; berto Caceres, manager. Has steam power and employs circa 100 men.

EVEDDOE MINING CO., LTD. **ENGLAND.**

Officers: 13, Throgmorton Ave., London, E. C., Eng. Mine office: Bod- n, Cornwall, Eng. W. H. Adams, secretary. Organized Aug. 13, 1900, th capitalization £100,000, shares £5 par; issued, £95,000. Debentures 7,500 authorized, £15,500 outstanding, at 5%. Lands, 500 acres, held on 0-year lease, subject to rental and royalty, bearing tin and copper ores. oduction, 1902 was 60 tons of black tin and 175 tons of 7% copper ore. perations, 1904, resulted in a net loss of £2,250.

REVIÑO y ZERTUCHE. **MEXICO.**

Office and mine: Viesca, Coahuila, Mexico. Lands include group of ims carrying gold, silver, lead, copper and iron. Idle for several years.

TRI-BULLION SMELTING & DEVELOPMENT CO. **ARIZONA, MONTANA & NEW MEXICO.**

Office: 119 Monroe St., Chicago, Ills. Mine offices: Kelly, Socorro Co., N. M., and San Carlos, Gila Co., Ariz. Employs 50 men. Hon. Howard Paschal, president and general manager; John B. Meacham, first vice-president; J. P. Hendricks, secretary; John W. Dundee, treasurer; preceding officers, Hon. John B. Corliss, Robert K. Brown, Louis J. Pierson, James Russell, Dr. R. J. Marshall and W. Topping, directors; Henry C. Erman and W. C. Defty, engineers; R. Skiff Shelden, chairman advisory committee. Organized 1903, under laws of Arizona, with capitalization $5,250,000, shares $1 par.

Lands include zinc property in New Mexico and copper property in Arizona. The Michigan gold mine, near Ishpeming, Marquette county, Michigan, was sold, 1905, to the Ishpeming Gold Mines Co., in which the Tri-Bullion holds a stock interest. Lands also include the Tri-Bullion group, in Jefferson county, Montana, idle at last accounts.

The Kelly mine, 13 claims, near Magdalena, New Mexico, is primarily a zinc mine, carrying values mainly in carbonates averaging 30% zinc, but has a little copper as well, values apparently changing from zinc to copper at depth. Development is by 3 shafts. The main working shaft, started 1905, has 3 compartments and was 120′ deep at the end of the year, there also being a 210′ two-compartment shaft. The Kelly has a steam plant and various mine buildings, and is producing considerable zinc ore.

The Arizona claims include the Tri-Bullion group of 8 gold and silver properties, apparently idle, and the Starlight group of 14 copper and lead claims, located in Godless Gulch, in the Stanley Butte district, 8 miles south of San Carlos. The Starlight mine was discovered 1886, but lands were set aside later, as part of the San Carlos Indian reservation, and were not segregated until 1901. Work by present company was begun January, 1903. Country rocks are quartzite, porphyry and limestone, showing occasional granite and diorite, carrying 3 known lenses of 20′ estimated average width, showing oxide and carbonate ores, giving average assays of 8% copper, 10 oz. silver and $4 gold per ton, in addition to values in lead, zinc, antimony and bismuth. The high grade ores run 8% copper, 40% lead, 10 oz. silver and $3.50 gold per ton. Considerable ore carrying circa 3% copper and 10% lead, with small gold and silver values, has been blocked out. The ore body, of 3′ to 20′ width, has given assays up to 32% copper, with considerable gold and silver values. The ore is low in silica and rich in lead and iron, rendering it self-fluxing, notwithstanding the existence of deleterious elements.

The principal claims are the Starlight and Will Ryan groups. The Starlight has shafts of 140′ and 200′, and a tunnel, planned to cut the main vein at a distance of 1,000′, giving a back of 500′, which already has cut 2 smaller veins showing auriferous and argentiferous copper ore. The Ryan crosscut tunnel is about 1,200′ long, and the property shows large reserves of low grade ore. Survey has been made for a 3,000′ tramline, with a 22%

e, from the Starlight mine to the wagon-road in Kelly gulch. The erty shows the remains of an old adobe smelter, 100 years or more of , as evidence that the mines were worked formerly by Mexicans or Spanls. The Southern Pacific and Santa Fé railroads are said to have united build a railway to Box Cañon, on the Starlight side of Gila river, which ll serve this property.

The Kelly zinc mine was a considerable producer, during 1905, of slightly ipriferous zinc and lead ores, and the Starlight mine shipped ore netting),876. Management seems good, and property is considered promising.

RIMETALLIC MINING, SMELTING & REFINING CO. MEXICO.

Office: care of P. Sandoval, treasurer, Nogales, Ariz. J. L. Shepard, resident. Presumably organized under laws of Arizona. Lands, 9 groups f claims, in the Ures and Hermosillo districts, Sonora, Mexico, with a govrnment concession for the equivalent of about 100,000 miners' inches of f water from the Yaqui river, which, under an effective head of 160′, can be ade to develop a large water-power. Property shows auriferous and arentiferous copper ores. Management is considered honest and property f more than average promise, but development is hampered by Yaqui Inian troubles.

RIMOUNTAIN MINING CO. MICHIGAN.

Office: 27 State St., Boston, Mass. Mine office: Trimountain, Houghon Co., Mich. Employs about 800 men. Wm. A. Paine, president; Fredric Stanwood, secretary and treasurer; F. W. Denton, general manager; receding officers, Chas. A. Paine, Chas. A. Snow, and J. Henry Brooks, directors, John Jolly, mining captain; H. T. Mercer, engineer; Edw. Koepel, mill superintendent; Benj. D. Noetzel, clerk; Jas. Vial, master mechanic at nine; James Richards, Jr., master mechanic at mill; Will Harris, supply lerk. Organized 1899, under laws of Michigan, with capitalization $2,500,000, shares $25 par; paid in, $20. Is controlled, through ownership of 99.135 shares of stock, by Copper Range Consolidated Co. Paid $300,000 in dividends under a former management. Old Colony Trust Co., Boston, registrar. Annual meeting, second Wednesday in February. Ended 1905 with cash on hand, $536,269.29, with total quick assets of $1,095,814.93, and total liabilities of $1,025,325.80, including old indebtedness, from the former management, of $540,542.49.

Lands, 1,120 acres, being the E. ½ of Sec. 19, W. ½ of Sec. 20, N. ½ of Sec. 29 and NE. ¼ of Sec. 30, all in Town 54 North, Range 34 West. The Baltic lies to the north and the Champion to the south, with undeveloped lands to the east and west. The Trimountain has a very heavy sand overburden surmounting the ledge, hence the mine was opened by sinking drop-shafts through the sand and crosscutting to the bed, raising thence to surface, on the angle of the lode. The Baltic bed runs 15′ to 50′ wide on the Trimountain tract, with an average width of about 25′, being well mineralized throughout, mass and barrel copper occurring near the walls. Masses upwards of a ton in weight have been found, but values occur mainly in the stamp-rock. Shafts are all of the same size and style, being 8x22′ outside

of timbers, with three compartments, framed with 14x14″ sticks, exceptionally heavy timbering being required to withstand the pressure from the shifting sand above the solid rock. Development of the mine was begun in 1899.

No. 1 shaft, 1,230′ deep at the end of 1905, sunk at an angle of 68°, is about 210′ north of the Champion boundary line. This shaft has a sand overburden of about 40′, with first level opened 168′ below the collar, levels being 100′ apart from thence downward, developing a long stretch of exceptionally uniform stoping ground of high grade. No. 1 has a 2,500 h. p. Nordberg direct-acting duplex hoist, having 36x72″ cylinders and double conical drum of 18′ maximum diameter, with capacity to hoist 6-ton skips from one mile depth. The shaft-rockhouse is of wood.

No. 2 shaft, 1,023′ northeast of No. 1, is 1,210′ deep, sunk at an angle of 68°. The hoist is a duplicate of that at No. 1. The shaft-rockhouse is 40x62′ on the ground and 84′ high, of steel frame, iron-sheathed, having 2,000-ton rock-bins, equipped with engine, steam-hammer and two 18x24″ crushers.

No. 3 shaft, 1,027′ northeast of No. 2, sunk at an angle of 68°, is 1,100′ deep, with a sand overburden of about 60′. Ground is much disturbed above the second level, but the formation becomes more regular at greater depth, showing many good stopes. Hoist and shaft-rockhouse are duplicates of those at No. 2.

No. 4 shaft, 710′ deep, is showing good ground. The shaft-rockhouse is a duplicate of those at shafts 2 and 3. The hoist is a temporary engine, good for a quarter-mile depth, and is to be replaced, eventually, with a hoist similar to those at shafts 1, 2 and 3.

No. 5 is in embryo as yet. The overburden at the site selected for No. 5 is 238′ in depth, of sand, mixed with boulders, and probably best could be penetrated by an upraise.

No. 6 also is merely a tentative site for a shaft, so located as to develop the Trimountain territory to the Baltic line.

The Trimountain was very rich, from surface to the 7th level, below which came considerable poor ground, but the eleventh and twelfth levels show marked improvement. Lying parallel with and circa 65′ west from the Baltic lode is a very wide amygdaloid, carrying some heavy copper and considerable stamp rock. This has been opened by a crosscut from the 7th level of No. 1 shaft, and has been explored to some extent, but nothing of great importance has been found. The great average width of the lode has led to successful experiments in dry-walling with waste-rock. Though at first ridiculed by some conservative mine managers, the use of culls for underground walls has proven its worth in the mines of the Baltic lode, and is being adopted in other Lake Superior mines having the same general underground conditions. Waste-rock is used also for building underground chutes. These are roughly circular, with inner diameter of about 5′, and are built up and filled about with waste as the stopes are carried upward, the chutes

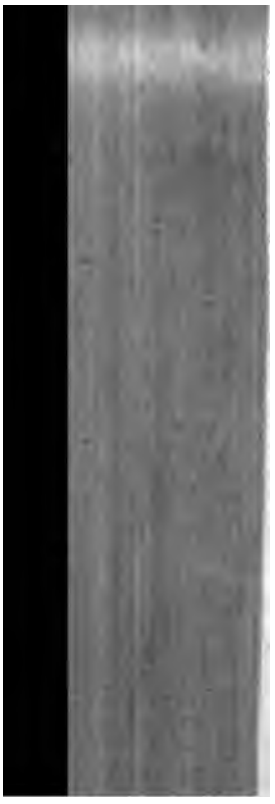
being built up at a sharp pitch. It was feared that descending rock might catch upon projections of the inner wall, built of rough mine-rock, but in practice no such trouble has occurred, the wedging of the surrounding waste-rock serving to hold the walls immovable. The saving in timbering from the use of dry-walling and mine-rock chutes is very great.

The principal mine buildings and machinery, in the neighborhood of shafts 2 and 3, include a 32 x45′ machine shop, 40x60′ carpenter shop, 25x45′ smithy and 30x60′ warehouse. There is a 35-drill cross-compound Rand air-compressor at No. 2 shaft, with a Deane condensing plant in a separate building adjoining. At No. 3 shaft the power plant is housed in a 68x180′ steel building, the plant including a battery of Stirling water-tube boilers and a 4,500′ Nordberg air-compressor, guaranteed to run 45 drills only, but actually running 65 drills, 10 pumps and sundry pneumatic machinery, giving a total duty equal to running 90 drills, or twice the rated capacity. At No. 3 there is a large coal trestle, supplying fuel to the boiler-room, and a cistern near No. 2 shaft stores water from a small brook for the boilers. A house over the cistern has a fire-pump, with hose, for defense of the mine buildings. It is planned to make more extensive use of electric power, for shafts and surface plants, and eventually for underground pumping.

There are a large boarding-house, general store and upwards of 100 dwellings at the mine location, which is enjoying a good growth and is improved with well macadamized roads. The mine is served by the Painesdale branch of the Copper Range railroad.

The 100-acre millsite, at Beacon Hill, 2 miles west of Redridge, has about one mile frontage on Lake Superior. The mill is 176x205′, of steel, on stone foundations, equipped with 4 Nordberg stamps, which were steeple-compouuded during 1905, the washing machinery for each stamp consisting of 36 improved Hodge jigs, 6 slime tables and one Wilfley table. The mill has a small but complete machine-shop, for repairs, on the second floor. The steel boiler-house has four 250-h. p. and two 200-h. p. Stirling water-tube boilers, latter maintaining a steam pressure of 180 to 200 lbs. per square inch, which is the highest pressure carried at any mill in the district, with a brick-lined self-supporting steel smokestack, 7′ 6″ in diameter and 165′ high, and an addition is being built for two 250-h. p. Stirling boilers. At the rear of the boiler-house are 3 coal-trestles, under each being a 6x7′ tunnel 400′ long, leading to the boiler-rooms, the floors of the sheds forming the roofs of the tunnels. Feed water for boilers is piped from a small stream, dammed 1,000′ distant.

The steel pump-house at the millsite has a 20,000,000-gallon Nordberg pump, taking water from a well connected with a 40″ riveted steel pipe, running 1,400′ to an intake crib in Lake Superior. The crib, which is built of heavy timbers, braced by iron rods, is 42x56′ on the bottom and 31′ high, sunk in 21′ of water, weighted with 1,800 tons of rock and anchored into the sandstone bed of the lake by heavy iron rods. The 40″ water-pipe is laid on the floor of the lake from the crib until shallow water is reached, and anchored to the rock bed of the lake by eye-bolts. The 500′ of this line nearest



fourth heads were started, in 1903, use of the Arca
Production begun with 37 lbs. fine copper per ton
per ton. When the present management assume
fell sharply, from 27 lbs. down to 18 lbs. per ton,
in 1905. The reason for this sudden decrease in pe
Thomas W. Lawson, the immaculate critic of fin
places, was the owner of a majority of the Trim
the old management to operate the mine on a ra
mine was gouged, rich rock removed and produc
level, through wilfully robbing the mine, at the
these tactics dividends aggregating $300,000 were
the mine was turned over to the Copper Range w
wards of $750,000. The Lawson management is
mentally dishonest. The Trimountain was rescu
dictation in time, and under the honest and cap
joyed, is slowly but surely getting upon an abs
able basis.

Production, 1905, was 10,476,462 lbs., a sma
year. Cost of copper was 10.5 cents per pound
or 10.93 cents per pound including constructio
stamped was $1.59 per ton for all ordinary wo
with construction included. Only 7.5% of the r
thanks to the system by which culls are made us
of being a dead expense for hoisting and surface-w
ing better underground than for three years p
highly capable and efficient.

TRINITY COPPER CO.

Office: 33 State St., Boston, Mass. Mine office
Forces, one $10,000-a-year general manager and

ds are the Shasta King and King Copper groups. The Shasta King group, claims, is 4 miles east of Iron Mountain, on the south fork of Squaw eek, adjoining the Balaklala mine. Development is by tunnels, main nnel being 7x8′ and 1,145′ long, with double tram-tracks and a 7x8′ double-ack tunnel has been driven 175′ lower. The mine has about 7,400′ of underground openings and the tract has been partially explored by 5,119′ of diamond drill borings. Ore body is a lense, claimed to be approximately 150′ wide by 1,000′ long, of unknown depth, said to give evidence of strength and to be likely to prove persistent to good depth. The mine is claimed, by the management, to have 1,200,000 tons of ore in sight, with nearly 500,000 tons blocked out for stoping, but this statement is denounced by Lewis W. Aubury, state mineralogist of California, who is a competent authority and an honest man, as a gross and wilful prevarication. The crosscut tunnels, driven in from the sides of the mountain, are connected by drifts in the ore body. Ore is a low-grade disseminated chalcopyrite, averaging somewhere between 1% to 4% copper, with about $1 gold and silver values per ton. Rumors have been printed that the ore body is merely a blanket vein, pinching out just below present workings, but best evidence is that the ore body is a lense of unknown but probably considerable depth.

The King Copper group of 22 claims, about 2½ miles south of the Shasta King, has about 1,000′ of development work, no ore having been found in place, as yet. The Statesman group has been explored, with a view to locating and developing silicious ores required for fluxing. The Uncle Sam group, held under option and lease by the Trinity, also has been explored for fluxing ores, the Trinity having large bodies of low-grade cupriferous pyrites, but lacking the silicious ores required to make free-smelting furnace mixtures. Some oxidized ore has been found at and near surface, this running 3%to 8% in copper tenor.

Surface improvements include a $20,000 office building, assay-office, hospital, warehouse, shops and about 25 dwellings for employes. The operating plant has steam power, a 6-drill air-compressor, power-drills and one diamond drill.

The company made a bluff at building a smelter, doing some grading in 1901, but the site has been sold since, and is occupied by the new smelter of the Mammoth Copper Co.

At the company's annual meeting, February, 1905, the president, Lawson, was authorized to build a smelter "according to specifications submitted by general manager Brown." There are no evidences of this smelter materializing.

There is considerable speculation as to what has become of the $972,000 of working capital intrusted to president Lawson, several years ago. No financial statement has been vouchsafed by the virtuous Lawson for some years. Presumably he has been too busy writing magazine articles attacking the Amalgamated Copper Co. In order to find funds to build the new smelter, the Boston Stock Exchange kindly permitted Lawson to list the balance of the Trinity stock, amounting to 80,000 shares, early in 1905. The Boston Stock Exchange has enjoyed an exceptionally good reputation heretofore,

but this matter of listing such utterly rotten stock as the Trinity is calculated to shake faith in the exchange. What the Boston Stock Exchange needs—and needs badly—is enough courage to back up its honest convictions.

In the prospectus of the Trinity Copper Co., issued Oct. 20, 1900, Lawson predicted that from August, 1901, the net earnings of the company would be "at least" two or three millions dollars yearly, and by that time "at least" $30,000,000 worth of ore would be blocked out. The mine is said to have been bought by Lawson for $165,000 and a stock consideration, and was capitalized at the modest sum of six millions, that being Lawson's idea of the "square deal" to his followers.

Lawson's mining career is malodorous. He boomed Arcadian at $75, and later it went to 75 cents. He unloaded Butte & Boston at a fancy price on his trusting employers, the Amalgamated. He gutted Trimountain and paid dividends when the mine owed nearly or quite a million dollars. He did the dirty work for the Amalgamated, and later pretended to expose that company. The Trinity is a fake, and the Boston Stock Exchange is an accessory after the fact.

TRINITY MINING CO. **MEXICO.**

Office: care of Pierce Underwood, 140 Dearborn St., Chicago, Ills. H. C. Reno, manager. The extensive advertising of this company is peculiarly unilluminating, the important facts given in the two-column advertisement of the company consisting of the name of the company, the alleged fact that its property is located in Sonora, Mexico, and the company's desire to sell its shares to the public, in order to permit investors to accumulate large profits suddenly.

TRIUMPH GOLD-COPPER CONSOLIDATED SMELTING, LAND & IRRIGATION CO.

A fraud, promoted by the notorious Wm. F. Wernse gang of swindlers.

MINA TROMPOSOS. **MEXICO.**

Office and mine: care of D. Luis Frey, owner, Unión de Tula, Jalisco, Mexico. Lands, 12 pertenencias, 12 miles east of Autlán, carrying a 30-metre vein, opened by a 100′ shaft, developing ore assaying 8% copper and 30 oz. silver per ton. Is a small producer, shipping ore to local smelters.

TROUT CREEK COPPER MINING CO.

Letter returned unclaimed from former office, Tacoma, Wash.

TROY COPPER CO. **ARIZONA.**

Merged, 1902, in Troy-Manhattan Copper Co.

TROY GOLD MINING CO. **COLORADO.**

Mine office: Granite, Chaffee Co., Colo. G. Falconer, superintendent, at last accounts. Ores carry gold, silver and copper. Has steam power and a 20-ton concentrator.

TROY-MANHATTAN COPPER CO. **ARIZONA.**

Office: 25 Broadway, New York. Mine office: Troy, Pinal Co., Ariz. Employs circa 60 men. John W. Sisson, president; Col. Chas. H. Cutting, assistant to the president and general manager; Vincent P. Tommins, secretary; Thomas Kavanaugh, superintendent; J. C. Devine, mine superintend-

ent; J. B. Lunn, chief clerk. Organized July, 1902, under laws of Maine, with capitalization $3,000,000, shares $10 par. Bonds, $300,000 authorized. $78,000 issued.

Lands, circa 1,200 acres, in the Troy district, about 6 miles northeast of Kelvin, with 5 claims more or less developed. Is said to have bonded, for $170,000, early in 1906, from J. B. Newman, 40 claims adjoining the Manhattan. The various mines have circa 6 miles of workings, and the Manhattan group is claimed to show 500,000 tons of 6% sulphide ore, which probably is an overestimate, as to either quality or quantity, or both.

The Troy property, which includes the Alice and other groups, with aggregate area of 567 acres, has 4 shafts, including a 500′ two-compartment main shaft, and about 7,000′ of tunnels. The main working tunnel of the Alice is circa 1,700′ long, intersecting the lode at a depth of nearly 800′. It is planned to connect the mouth of this tunnel with the smelter by an aerial tram. Ores of the Alice are slightly auriferous and argentiferous oxides and sulphides, ranging 8% to 16% in tenor, smelter returns for 1902 having given an average of about 10% copper. Vein is 3′ to 11′ in width, increasing at bottom of shaft, where it is very soft and requires spilling. The 400′ Sisson shaft shows a 6′ vein of sulphide ore, apparently a fissure in limestone, said to average about 5.5% copper.

The Buckeye has a 375′ two-compartment shaft, in a 5% ore body having a 2′ paystreak assaying 9% copper, and the Buckeye winze is said to show a 25′ vein of malachite giving smelter returns of 6% to 10% copper. On the '91 claim there is a 2′ to 8′ vein of wulfenite, from which the company plans to produce commercially, a 40-ton concentrator having been built for the purpose, near the Davis shaft.

Equipment includes 2 gasoline hoists, a Leyner air-compressor and an electric plant. Petroleum is used exclusively for fuel. The old 60-ton smelter, at Riverside, on the Gila river was blown in, early in 1901, and closed down permanently, August, 1904. The plant never ran regularly, and experienced much trouble from shortages of both coke and water. The new smelter was blown in January, 1905, but closed down after 10 days run, owing to serious washouts that prevented receipt of both coke and petroleum. Just why the new smelter has not been in blast since is not apparent. The management makes frequent changes in plans and at last accounts was planning yet one more reduction plant. Company is said to have a molybdenum refining plant, at Newark, N. J., but this statement has not been verified. Property is 75 miles from a railroad, and production cannot be put on a satisfactory basis until rail connection are secured. Results, to date, have been disappointing.

TRUE BLUE COPPER MINES, LTD. **BRITISH COLUMBIA.**

Letter returned unclaimed from former mine office, Ainsworth, B. C.

TRUST RUBY MINE. **COLORADO.**

Letter returned unclaimed from former mine office, Ouray, Colo.

TSCHOUDAK MINE. **RUSSIA.**

A small producer in the Russian Altai. Has a vein ranging up to 24′ width, carrying chalcopyrite, with quartz gangue.

TSUBOI MINE. **JAPAN.**

Mine office: Tsuboi-mura, Kume-gori, Mimasaka, Japan. Ore is chalcopyrite, associated with iron pyrites, said to average 13% copper and 0.2% silver, occurring in three principal veins of 2′ to 4′ width, running parallel to plane of stratification of paleozoic clay-slate and schalkstein. Production, 1903, was 218,808 lbs. fine copper.

AKTIEN-GESELLSCHAFT TUBALKAIN. **GERMANY.**

Mine office: Adenau, Rheinprovinz, Germany. Has ores of copper, lead and iron. Idle at last accounts.

TUBUTAMA MINING & REDUCTION CO. **MEXICO.**

Mine office: Tubutama, Altar, Sonora, Mex. Lands, 300 pertenencias, including a number of antiguas, adjoining the Sonora Mining & Milling Co. Property said to be promising. Idle.

TUCK MINE. **VIRGINIA.**

Owned by Pontiac Mining Co.

SOCIÉTÉ DES MINES DE TUCO-CHEIRA. **PERÚ.**

Office: 50, Blvd. Hausmann, Paris, France. Mine office: Casilla 10, Huaraz, via Casma, Perú. Capitalization, 2,500,000 francs.

TULAROSA MINING & MILLING CO. **NEW MEXICO.**

Mine office: Tularosa, Otero Co., N. M. Lands, sundry claims, 10 miles from Tularosa. Shipped a sample carload of ore to the Copper Queen smelter, at Douglas, Arizona, September, 1905.

MINA TULIPAN. **CHILE.**

Mine office: Chañaral, Atacama, Chile. Zoilo Rojas, owner; R. Olquin, superintendent. Has steam power and employed 50 men, at last accounts.

TULLY COPPER MINING CO. **COLORADO.**

Office: Encampment, Wyo. Mine office: Pearl, Larimer Co., Colo. Leo Davis, president and general manager; F. J. Lordier, secretary and treasurer; J. D. Tully, superintendent. Organized 1901, under laws of Wyoming, with capitalization $1,000,000, shares $1 par. Lands, 12 acres, patented, also a 6-acre millsite, showing 4 fissure veins, carrying oxide and carbonate ores, of which one, opened by a 175′ shaft, is said to average 25′ width and to carry average values of 6% copper and $4 gold per ton. Has steam power.

TUNABERG MINE. **SWEDEN.**

A Swedish property, producing mainly silver, with lead and copper as by-products. Main shaft was 588′ deep, at last accounts.

TUOLUMNE COPPER MINING CO. **MONTANA.**

Mine office: Butte, Silver Bow Co., Mont. Organized, circa June, 1906, with capitalization $800,000, shares $1 par. Lands, one fractional claim, in litigation, adjoining holdings of the North Butte.

TURGOVSKI WORKS. **RUSSIA.**

Mine office: Perm, Russia. D. T. Zaharovski, manager. Production, 1900, was 111,686 lbs. fine copper.

TURK MINING & MILLING CO. **WASHINGTON.**

Office: Davenport, Wash. Mine office: Turk, Stevens Co., Wash.

A. H. Stiles, superintendent. Ores carry gold, copper and silver. Was developing, on a modest scale, at last accounts.

TURQUOISE COPPER MINING CO. **ARIZONA.**

Mine office: Gleeson, Cochise, Ariz. W. H. McKittrick, superintendent, at last accounts. Presumably idle.

TUSAS PEAK GOLD & COPPER MINING CO. **NEW MEXICO**

Office: 364 River St., Manistee, Mich. Mine office: Tres Piedras, Taos Co., N. M. Louis E. Morris, president; Constantine Fleissner, vice-president; J. W. Sibbens, secretary; Otto Rosenfeld, treasurer; Frank Bolton, superintendent; preceding officers, Max Bauman, J. W. Murray, James De Ball and Felix Grant, directors. Organized under laws of New Mexico, with capitalization $2,000,000, shares $1 par.

Lands, 13 claims, area 230 acres, in the Bromide district, circa 14 miles west of Tres Piedras. Principal development is on the Tampa mine, said to show a 13′ vein of auriferous and argentiferous copper ore, carrying a 5′ pay-streak of smelting ore and 8′ of milling ore. Company claims that some of the ore carries platinum, also that the Tampa mine has a 406′ shaft, with 1,300′ of workings. Ores are reported by company to assay 5% to 44% copper, 1 oz. to 4.5 oz. silver and $1.20 to $3.80 gold per ton, with assays up to 2.2 oz. platinum per ton, and with more or less molybdenum.

The company has installed a hydraulic ram, on Tusas creek, and has a 3-drill air-compressor. At end of 1905, management planned building a 100-ton mill, to do custom work also, and was said to have ordered equipment for same.

TWENTIETH CENTURY GOLD MINING CO., LTD. **ONTARIO & ARIZONA.**

Office: 29 Broadway, New York. W. K. Dunlap, president; G. Sack, vice-president; Dr. John G. Mollath, secretary; W. Reed McCabe, treasurer; preceding officers and J. V. W. Cook, directors. Organized circa 1898, under laws of Ontario, with capitalization $2,000,000, shares $10 par. Company was promoted by one Anthony Blum, a rascal, and paid dividends from stock sales, until January, 1904, when Blum disappeared, and the company became bankrupt. The company has been reorganized, by shareholders, with an entirely new and presumably honorable management, after more or less litigation in the Canadian High Court of Justice.

Lands are in 3 groups, including 2 copper claims in Cochise county, Arizona, 200 acres of gold-bearing lands in El Dorado county, California, and 270 acres of gold lands in the Manitou Lake region, Rainy River district, Ontario, equipped with several small buildings.

TWIN BUTTES MINING & SMELTING CO. **ARIZONA.**

Office: 121 Wisconsin St., Milwaukee, Wis. Operating office: Tucson, Ariz. Mine office: Twin Buttes, Pima Co., Ariz. Employs circa 160 men. David S. Rose, president; W. A. Barber, vice-president; preceding officers, John G. Baxter. E. P. Hackett, Edward P. Davis, Robert Nunnemacher and J. Blakely, secretary; W. B. Hill, assistant secretary; John G. Baxter, mine superintendent. r laws of Arizona, with capitalization

$1,000,000, increased, circa 1905, to $1,250,000, shares $1 par. Statement of finances, as of date Dec. 1, 1905, gave cash on hand, $18,000, since which date $250,000 in treasury stock has been sold, and proceeds will be used to finance the company. Wisconsin Trust Co., Milwaukee, transfer agent and registrar. Annual meeting, first Monday in January.

Lands, 61 claims, area 1,250 acres, partly patented, in the Helvetia district, 28 miles south of Tucson, in the foothills of the Sierrita Mountains. Property was first opened in 1880, but never was successful, owing to lack of cash and management, though always considered rich. Lands carry sundry fissure veins in limestone, and contact veins between limestone and granite, with a limestone footwall and granite-porphyry hanging-wall. Development is by a 200′ shaft, with 550′ of laterals, on the Senator Morgan mine, showing a vein of 25′ average width, with proven depth of 95′ and proven length of 300′, carrying sulphide ore of circa 10% copper tenor in the bottom workings. The Copper Glance mine is opened by a 415′ shaft, with 450′ of laterals, shaft passing through a 30′ iron capping and 200′ of carbonate ore, and on the 300′ level a crosscut passed through 35′ of marcasite, carrying kidneys of chalcocite, and a crosscut on the 400′ level encountered a ledge of soft leached ore, considered decidedly promising. The Copper King mine has a 250′ shaft, with 250′ of laterals, showing carbonates in the upper workings, with sulphides coming in at the bottom, the showing being promising. The various properties of the company have about one mile of underground workings, estimated to give 50,000 tons of ore blocked out for stoping, with 10,000 tons on the dumps, ore averaging circa 7% copper and 1.85 oz. silver, with traces of gold.

Equipment includes a small steam plant at the Morgan, and gasoline power at the Copper King mine. During 1906 the company will install a new machinery plant at the Morgan, to include 300-h. p. boilers, a double-drum hoist good for 3,000′, and an 8-drill Ingersoll-Rand air-compressor. The property has 14 buildings, including a machine shop, smithy, engine-houses, store, etc. Water for a smelter can be secured from the Santa Cruz river, 5 miles distant.

The company has a private rail line, known as the Twin Buttes Railroad, 27 miles in length, from Tucson to Twin Buttes, which was completed to the mines circa July 1906. This line will be extended, eventually, toward Nogales. Equipment includes 1 locomotive and 3 flat-cars, to be increased as circumstances may warrant. Fuel is wood, to be replaced by petroleum, as soon as possible.

The company planned shipping circa 200 tons of ore daily, mainly heavy sulphides, with a little oxidized ore, during latter part of 1906. Management is good, and property is considered promising.

TWIN CITY DEVELOPMENT CO. **COLORADO.**

Office: care of C. O. Patton, secretary and treasurer, Chicago, Ills. Letter returned unclaimed from former mine office, Turret, Chaffee Co., Colo. W. J. J. Root, president; J J. New, general manager. Lands, 5 patented claims, known as the Vivandiere group, apparently leased to the Vivandiere

Consolidated Mining & Smelting Co., also the Twin City group, 13 claims, and the townsite of Minneapolis. Mine is opened by a 615′ shaft, and has considerable development. Equipment includes a 25-ton concentrator planned to be enlarged, eventually, to 50 tons daily capacity, which puts about 10 into 1, when working.

TWIN-EDWARDS COPPER MINE CO. **NORTH CAROLINA.**

Office and mine: Greensboro, Guilford Co., N. C. Organized September, 1902, with capitalization $100,000, shares $100 par. Lands are sundry old properties, including the Twin mine, with an 18′ vein, which was worked previous to the American Civil War. Has steam power.

TWO BIT GOLD & COPPER MINING CO. **COLORADO.**

Supposed to have had claims in the Two Bit district of Colorado.

TYEE COPPER CO., LTD. **BRITISH COLUMBIA.**

Offices: 45, Leadenhall St., London, E. C., Eng. Mine office: Duncans, Vancouver Island, B. C. Works office: Ladysmith, Vancouver Island, B. C. Thomas Headland Wilson, chairman; preceding officer Ludwig Loeffler, Albert Straube, Nicol Brown and Harry Von Berg, directors; Clermont Livingston, general manager; Edward Christopher Musgrove, mine superintendent; Wm. James Watson, smelter superintendent.

Organized April 4, 1900, under laws of Great Britain, with capitalization £180,000, shares £1 par. Dividends were 10% in 1904 and 10% in 1905.

Lands, 13 claims, crown-granted, area 342 acres, also a 45-acre smelter-site, 60-acre tramway terminal and 800 acres timber lands, all in the Somenos district, adjoining the Lenora mine, on Mt. Sicker, circa 11 miles northwest of Duncans, and about 80 miles from Vancouver. Country rocks are schists and diorite, carrying lenses in banded schists, the schists themselves carrying up to 2% copper, with small gold and silver values, and being suitable for fluxing. Ore averages 4% copper, 2.5 oz. silver and $3 gold per ton, also carrying circa 38% barium sulphate, and about 7% zinc, rendering the ore refractory in smelting. That it is so well smelted is a great credit to the local management of the company.

The main shaft is 1,000′ deep, showing a 3′ ore body on the 1,000 level. No. 2 shaft is 200′ deep, and No. 3 shaft, on the XL claim, with 2 compartments, is 150′ deep, and is to be deepened. The mine has about 2 miles of underground workings, showing about a year's supply of ore, though estimated by Mr. Fred O. Harvey at 12,000 tons only.

Equipment, at the mine, includes 5 boilers, 20-h. p. and 50-h. p. hoists, 5-drill and 10-drill air-compressors, and a pumping plant raising 100,000 gallons daily in a single lift of 1,000′. There also is a sawmill and an ore-dressing plant at the mine. The concentrator, at the main shaft, has a No. 4 Gates crusher, Blake crusher, grizzley, rolls, grinders, Snyder automatic samplers and an ore-sorting belt. From the sorting-belt ore is delivered to 100-ton ore-bunkers, and thence to a 3½-mile aerial tram with half-ton buckets, operated by a 4-h. p. engine for starting, gravity furnishing the motive power, there being a drop of 2,000′ between the mine and

the 400-ton ore-bunkers at the lower terminus of the line, on the Esquimault & Nanaimo railway. From the lower bunkers ore is carried 17 miles, by rail, to the smelter, in 30-ton bottom-dumping cars. Buildings at the mines include an engine-house, boiler-house, smithy, carpenter shop, store, boarding-house and bunk-house, all of wood.

The smelter, at Ladysmith, is well located, having a 45-acre site on Oyster Harbor. A notable feature of these works is the roast-yard. Ores are dumped from the railroad hopper-cars into sixteen 100-ton receiving bins, with hopper-bottoms and screen-tops, latter set at angle of 40°, all fines under ⅜″ mesh falling into separate compartments built in the center of each bin. The level of the roast-yard is about 8′ below the tram-tracks running under the receiving bins. The yard has 6 permanent trestles, 60′ apart from center to center, and at right angles to the permanent trestles are 6 trenches, each 4′ deep and 40′ from center to center. Between the permanent trestles are movable bridges, traveling on wheels, these being trussed so as to clear the roast-heaps below. Both permanent trestles and movable bridges have tram-tracks, with turntables, over which travel side-dumping ore-cars, which thus obtain easy access to every square foot of the roast-yard. Roast-heaps are built up automatically by dumping the tram-cars, each heap averaging 24x50′ size on the bottom, by 7′ height, and containing an average of 300 tons. Each roast-heap requires an average of 8 cords of wood, and burns about 3 weeks, reducing the sulphur contents to about 5%. The system works perfectly, cintering being reduced to a minimum. When roasted, ore is shoveled into 2¼-ton ore-cars, traveling on tram-lines laid in the bottom of the trenches before mentioned, tops of cars being on a level with bottoms of the roast-heaps. Roasted ore is trammed to the burnt-ore bins, 1,500′ distant and just behind the blast-furnace building, there being eighteen 50-ton bins, with central bottom-discharge gates, emptying into tram-cars running over scales to the charging-floor of the furnace. The Tyee roast-yard is the best-planned, taking all things into consideration, of any in existence.

The smelting plant, terraced throughout, to permit handling of material by gravity, has a 56x81′ furnace building, of wood, with a 200-ton Allis-Chalmers water-jacket blast-furnace, 42x120″ at the tuyeres, using a hot blast, with room for a second furnace of the same size. The furnace has a water-jacket forehearth for matte, slag skimming into a settler and thence into a sluice, where granulated and washed away by running water. The dust-flue, 8x11x165′, arched over with corrugated iron, leads to a 90′ smoke-stack, of 7′ diameter. The furnace reduces 9.45 tons of ore and flux with one ton of coke. The reduction plant also includes a complete sampling mill, briquetting plant for fines, electrolytic assay plant and an electric light plant. The plant also does some custom business, handling ores from British Columbian and Alaskan mines, and sells its product, as a 50% matte, to American smelters having bessemerizing works.

Production, for the calendar year 1905, was 3,039,398 lbs. fine copper, 103,474 oz. fine silver and 5,952 oz. fine gold, as compared with 5,120,870 lbs.

copper, 179,769 oz. silver and 11,088 oz. gold in 1904, the falling off being due to the inability of the mine to furnish as much ore as could be used to advantage. The management is excellent, and it is to be hoped that the work now under way at the mine may lead to the development of larger ore bodies, to replace the partially exhausted reserves.

TYRONE DEVELOPMENT CO. **NEW MEXICO.**

Office: care of Chester A. Congdon, Duluth, Minn. Mine office: Silver City, Grant Co., N. M. A close corporation, organized June, 1906, with capitalization $300,000, shares $10 par, by Thomas F. Cole, John D. Clark, James L. Norman, Lee W. Farmer, James Wanless, W. W. Billson and Chester A. Congdon, to develop sundry prospects in the Silver City district.

TZAREVO-ALEXANDROVSKI WORKS. **SIBERIA.**

Office, mine and works: Semipalatinsk, Siberia. Mines are said to be rather promising, though slightly developed, giving an average annual production of circa 500,000 lbs. fine copper.

UBEHEBA COPPER CO. **CALIFORNIA.**

Capitalization $1,000,000, shares $1 par. Lands, sundry claims, about 50 miles south of Goldfield, Nevada, in the Ubeheba Mountains, near Death Valley, Inyo county, California, said to show veins of 8′ to 50′ width, carrying auriferous and argentiferous ores, up to 20% in copper tenor.

UDO MINE. **JAPAN.**

Mine office: Usagi-mura, Hikawa-gori, Izumo, Japan. Ores are chalcopyrite and bornite, accompanied by hematite and limonite, occurring in a vein of 3′ to 18′ width and 320′ length. Was worked extensively, 1870-1881, but present production is trivial, mine being nearly exhausted.

UGURCHAISKA & GALIZURSKI MINES. **RUSSIA.**

Office: care of G. Chaimazidi, manager, Batum, Russia. Kunderov Bros., owners. Mines, in the government of Elizabethpol, are small producers only.

UINTAH COPPER SUMMIT CO. **UTAH.**

Office: 25 Equitable Bldg., Boston, Mass. Mine office: Vernal, Uintah Co., Utah. W. M. Payson, treasurer. Country rock is cherty limestone, carrying pockets of malachite and chalcocite. Property is known as the Dyer mine, and has been idle several years.

UNITAH MINING & MILLING DEVELOPMENT CO. **UTAH.**

Letter returned from former mine office, Bingham Canyon, Salt Lake Co., Utah. L. C. Moore, general manager; F. D. McNeill, superintendent. Is said to have bought the Castro group, opened by a 700′ tunnel, at Bingham Canyon, 1905. Apparently is some relation to the Castro-Grecian.

ULCAHOMO MINING & MILLING CO. **WYOMING.**

Office: care of Le Roy Grant, president and general manager, Cheyenne, Wyo. Lands, 11 claims, area 220 acres, 1¼ miles from the Strong Copper Mining Co., in Natrona county, Wyoming, opened by shafts of 35′ and 100′, and equipped with a small steam plant.

ULIDA GROUP. **CALIFORNIA.**

Office: care of Wm. L. Hunter, owner, Lone Pine, Cal. Lands, 8 claims,

in Inyo county, California, showing contact veins between limestone and granite, carrying auriferous and argentiferous malachite and tetrahedrite, with occasional cuprite. Has made small smelter shipments of hand-sorted high-grade ore. Idle.

UNAWEEP COPPER MINING & MILLING CO. **COLORADO.**

Office: care of James V. Howard, secretary, Grand Junction, Colo. Organized under laws of Colorado, with capitalization $500,000, shares $1 par. Lands, 6 claims and a millsite, in the Unaweep district, slightly developed. Has steam power. Presumably idle.

UNCLE SAM CONSOLIDATED MINING CO. **UTAH.**

Mine office: Eureka, Juab Co., Utah. Ores carry gold, silver, copper and lead. Has steam power.

UNCLE SAM COPPER CO. **ARIZONA.**

Office: 1743 West 25th St., Los Angeles, Cal. Mine office: Gilbert, Yavapai Co., Ariz. Milo Baker, president; W. T. Somes, secretary, treasurer and general manager. Organized July, 1901, under laws of Arizona, with capitalization $1,000,000, shares $1 par. Lands, 5 patented claims, area circa 100 acres, 12 miles from a railroad, showing several ore bodies, of which one has a 188′ shaft, showing a 5′ to 6′ ore body, giving assays of $20 to $40 per ton in copper, gold and silver, mainly from oxidized ores, with some sulphides carrying high values in gold and silver. Idle for several years, but company hopes to resume work, late in 1906.

UNDERLAY MINE. **AUSTRALIA.**

Mine office: Dandaloo, New South Wales, Australia. Lands, circa 20 miles west of Dandaloo, adjoin the Mount Royal mine, showing a 5′ vein carrying high-grade oxide, carbonate and sulphide ores, ranging up to 40% in copper tenor.

MINAS UNIÓN y CONSTANCIA. **MEXICO.**

Office and mines: Indé, Durango, Mexico. Reinaldo E. Avila, general manager. Mines were opened in the Sixteenth Century. Country rock is andesite, showing 9 ore bodies, carrying chalcopyrite, galena and sphalerite, associated with iron pyrites. Ore body under development averages 2 metres width and is opened by a shaft of 18m. and tunnels of 70m. and 100m., developing first-grade ore averaging 43% lead, 100 oz. silver and 54 oz. gold per metric ton, and second-grade ore averaging 4% copper and 20 oz. silver per ton, latter showing a little native copper. Smelter, 4 miles from the mine, has two 30-ton water-jacket blast-furnaces, shipping matte to the Aguascalientes works of the American Smelting & Refining Co., for conversion and refining.

UNION COPPER LAND & MINING CO. **MICHIGAN.**

Office: 60 State St., Boston, Mass. Mine office: Calumet, Houghton Co., Mich. H. F. Fay, president; Geo. G. Endicott, secretary and treasurer; James Chynoweth, superintendent; preceding officers, John C. Watson, Rogers L. Barstow and C. D. Coffin, directors; J. Abner Sherman, land agent. Organized 1863, and reincorporated 1893, under laws of Michigan, with capitalization $2,500,000, shares $25 par; issued $2,000,000. Annual meeting,

fourth Thursday in March. Old Colony Trust Co., Boston, registrar. Net expenses for 1905 were $5,784.17, leaving a cash balance, at end of year, of $63,723.42.

Lands, circa 200 different parcels, area upward of 7,000 acres, practically all on the mineral belt, in Keweenaw, Houghton, and Ontonagon counties, Michigan, much of the land being covered with valuable timber, including pine, hemlock and hardwood, mainly the latter. One tract of 160 acres is under option to the Erie-Ontario Development Co. The construction of the Keweenaw Central railway will add greatly to the prospective value of the company's holdings on Keweenaw Point.

UNION COPPER MINING CO. **CALIFORNIA.**

Office: care of Estate of Fredk. L. Ames, Boston, Mass. Mine office: Copperopolis, Calaveras Co., Cal. David Ross, superintendent. Controlling stock interest is owned by the Ames Estate, Boston. Lands include the Union, Keystone and Empire mines, also 2 claims adjoining the Alto, in Del Norte county, California. Mines, opened 1861, were considerable producers, paying fair dividends, circa 1861–1866. Formation is a black pyritous slate, in amphibolite schists, this belt running from Tuolumne county, on the south, through Calaveras into Amador county, on the north. The vein of pyritous slate is 33′ to 40′ wide, with strike of 30° East of South and a dip of 30° to the East. Ore occurs as lenses of 15′ average width, connected by stringers, main lense being 2′ to 40′ wide and 600′ long. The alteration zone, circa 30′ in depth only, carries rich oxides and carbonates, and some native copper, below which occurs chalcopyrite, carrying neither gold nor silver, and unusually free from arsenic, antimony, bismuth and other undesirable elements. So pure is the ore that the blister copper therefrom makes good wirebars, without electrolytic refining. Ore is classified in two grades, as smelting ore of 10% to 11% copper tenor, and as leaching ore carrying 5% to 5.5% copper. Main shaft, 60′, is bottomed in a 15′ lense of medium-grade ore, and the mine has a mile of openings in ore. Equipment includes a hoist, pumps, etc., with necessary mine buildings. Has a 100-ton Orford smelter, installed 1889. Operations were confined, for many years, to producing cement copper, by leaching the old dumps, which are extensive. At last accounts smelter had been overhauled, a 90′ steel gallows-frame built, the main workings cleaned out and retimbered, and plans laid for an active campaign of production.

UNION COPPER MINING CO. **NORTH CAROLINA.**

Office: 52 Broadway, New York. Mine office: Gold Hill, Rowan Co., N. C. Calvin H. Allen, president and treasurer; Temple T. Berdan, secretary; preceding officers, T. C. Buck, Jr., Berlin C. Brown, D. D. Drummond, R. P. Doremus, E. Fletcher, Jr. and H. F. Warren, directors; H. L. Griswold, superintendent. Organized 1899, under laws of New Jersey, with capitalization $3,000,000, shares $10 par.

Lands, circa 1,150 acres, about 15 miles from Salisbury, in Rowan and Cabarrus counties, North Carolina, well watered and timbered, showing 3 copper veins and one vein each of copper, gold and silver, with a little work

done on the silver and gold veins. Principal mining development has been on the "Big Cut" copper vein, which has 10 shafts, of 150′ to 650′ depth, along the strike of the vein for a distance of nearly a mile. The upper levels show an ore body of 20′ to 40′ width, carrying oxidized ores and a little native copper, ore on the lower levels being chalcopyrite, with quartz gangue, in a vein of 8′ to 16′ width, with slate walls. Mine was claimed to average 10% copper, 3 oz. to 30 oz. silver and $1.50 to $7.50 gold per ton, but a careful sampling, by Dr. A. R. LeDoux, gave averages of 4.4% copper, 4 oz. silver and 40 cents to $1.20 gold per ton. Ore occurs as lenses and chutes, in a mineralized zone, the lenses averaging about 100′ in length.

The machinery plant is extensive, but poorly planned, including 27 boilers, 18 hoists, 3 air-compressors and an electric light plant. The property has 4 dams, with storage capacity for 3 months' operations, and a 25,000′ sawmill. Buildings include a 45x70′ machine shop, 40x60′ smithy, iron and brass foundry, concentrator, smelter, sundry engine-houses and boiler-houses, stable for 400 horses and mules, office building, 50-room hotel and 130 dwellings.

The reduction plant includes a concentrator and smelter, latter having roasters and two 40-ton blast-furnaces, blown in September, 1901, and blown out June, 1902.

Company's affairs were badly muddled by the former management, which apparently was interested mainly in the stock-market. The mine has been worked on a small scale since the smelter was blown out, and is sending silicious concentrates, for fluxing, to the Tennessee Copper Co., beginning with shipments of 375 tons in March, and increasing to 1,100 tons in August, 1905, production of the year being estimated at 850,000 lbs. fine copper. The management levied a voluntary assessment March 20, 1906. Property is considered of considerable promise, if extensively developed, given a modern equipment, and worked with a view to mining profits, rather than stock-market profits

UNION COPPER MINING CO. **WYOMING.**

Office and mine: Encampment, Carbon Co., Wyo. Henry C. Hedges, president; A. E. Mosier, secretary. Organized under laws of Wyoming, with capitalization $1,000,000, shares $1 par. Lands, 100 acres, 3 miles from Encampment, slightly developed. Has steam power. Property is well regarded. Idle.

UNION COPPER SMELTER CO. **ARIZONA.**

A fraud. Same as Union Copper Smelting Co.

UNION COPPER SMELTING CO. **ARIZONA.**

A fraud, promoted by the notorious Wm. F. Wernse gang, of St. Louis

UNION DEVELOPMENT CO. **CALIFORNIA.**

Letter returned unclaimed from former office, Boston, Mass. Property was the Juanita claim, in the Morrow district, 26 miles east of Johannesburg, San Bernardino county, California, showing a contact vein, between granite and limestone, carrying auriferous chalcopyrite, with talcose gangue, opened by 4 shafts, deepest 212′. Idle some years.

UNION ORE EXTRACTION & REDUCTION CO. **COLORADO.**

Reorganized, circa 1905, as National Radium & Copper Co.

UNITED ALKALI CO., LTD. **SPAIN.**

Offices: St. Helens, England. Mine office: Huelva, Spain. Wm. Guthrie Bowie, mine manager. Capitalization, £8,750,000. Has paid 19% on common stock, since 1890. Company is a chemical and manufacturing corporation, with which copper mining is merely a small branch of the general business, and controls 46 subsidiary works and companies, some of great size. Has large works at St. Helens, Runcorn, Flint, Widnes and Glasgow, making extensive use of Spanish and Portuguese pyrites, which are burned for sulphur, the cinder of the cupriferous pyrites being leached for copper.

The principal copper property of the company is the Monte Rubio group held under lease from C. & J. Sundeim, this including the Monte Rubio, Gibraltar and Atbalcal Arbalcal mines, having a combined area of circa 100 hectareas, at Paimogo, Huelva, Spain. These are ancient properties, worked only to the level of the nearest stream, in the Roman era, the old workings, though comparatively superficial, disclosing enormous masses of ore, occurring as oxides, carbonates, sulphides and sulphate, with gangue of iron ore, indicating the existence of large bodies of unaltered iron-copper sulphides at greater depth.

The company also leases El Tinto and La Santa Rosa mines, with adjoining properties, area 141 hectareas, at Zalamea la Real, Huelva, Spain, from the Sociedad de las Minas de Cobre Tinto y Santa Rosa. Company also has sundry undeveloped mineral leases on the river Guadiana, and has a 22-kilometre railway from Monte Rubio to Coiña Veral, on that river, with wharves for shipping ore to Great Britain. A 9-kilometre Bleichert aerial tram connects the mines with the railway at Calañas. Production, 1904, was 86 long tons of cement copper and 31,394 tons cupriferous pyrites.

UNITED ARIZONA COPPER CO., LTD. **ARIZONA.**

Offices: 38, Broad Street Ave., London, E. C., Eng. Rt. Hon. Earl of Orford, chairman; W. P. Guthridge, mine manager; J. F. Shearer, secretary. Organized Oct. 15, 1902, with capitalization £200,000, shares £1 par; issued, £160,000. Lands, 500 acres, in Pinal county, Arizona, said to have been bought for £160,000 cash, carrying auriferous and argentiferous copper ores. Main shaft, 600′, is said to develop considerable ore bodies. Equipment includes a 30-ton smelter, and erection of a 100-ton smelter and leaching plant has been contemplated, for several years, but has not materialized. Ore smelted in the past is said to have averaged 9% copper, with considerable gold and silver values. Management claims that work is in progress. Regarded with suspicion.

UNITED BINGHAM CONSOLIDATED MINING CO. **UTAH.**

Tentative title for proposed consolidation of the United Bingham Gold & Copper Mining Co. and Silver Shield mine.

UNITED BINGHAM GOLD & COPPER MINING CO. **UTAH.**

Office: Salt Lake City, Utah. Mine office: Bingham Canyon, Salt Lake Co., Utah. Louis Moore, president; A. Hanauer, Jr. secretary; Harry Joseph,

superintendent. Lands, several patented claims, partly developed by the Snowstorm tunnel, which has opened a 4′ vein assaying 2% copper, 25% lead and up to $8 gold per ton. Presumably idle.

UNITED BUFA MINES. **MEXICO.**

Office: 1 Exchange Place, Jersey City, N. J. Organized 1903, under laws of New Jersey, with capitalization $300,000, shares $1 par, to mine copper and other ores in Mexico. Apparently abortive.

UNITED COPPER CO. **ARIZONA.**

Presumably dead. Organized Nov. 8, 1899, under laws of Arizona, with capitalization $50,000. Chas. M. Moore, secretary; Andrew A. Meyer, treasurer.

UNITED COPPER CO. **MONTANA.**

Office: 42 Broadway, New York. F. August Heinze, president and general manager; Arthur P. Heinze, vice-president; John MacGinnis second vice-president; preceding officers, Stephen E. Nash, Isaac S. Taylor, Frederick A. Martens, G. Reusens, Otto C. Heinze and Max N. Schultz, directors; Stanley Gifford, secretary and treasurer. Organized April 28, 1902, under laws of New Jersey, with capitalization $80,000,000, shares $100 par, in $5,000,000 preferred 6% cumulative shares and $75,000,000 common shares, of which all the preferred stock and $45,000,000 of common stock have been issued. American Loan & Trust Co., Boston, C. S. Buckingham, 42 Broadway, New York and Union Trust Co., New York, transfer agents; Metropolitan Trust Co., New York, Old Colony Trust Co., Boston, and Fidelity Trust Co., Pittsburg, registrars. Annual meeting, first Wednesday in June. Stock is listed on the Boston and Pittsburg stock exchanges.

Preferred stock is redeemable at $125 per share, in full or any portion thereof, upon any dividend date, by the company giving 3 months' notice, and it is probable that a portion of the preferred stock will be retired November 15, 1906. The board of directors has power to fix, determine and vary the disposition of any surplus, etc., from time to time, the powers of the board being practically absolute.

The company has paid regular 6% dividends on its preferred stock, since organization. First dividend on common stock was paid 1905, the company having paid, to end of 1905, dividends of $1,500,000, same being $1,500,000 on the preferred and $450,000 on the common stock. A second dividend, on the common stock, amounting to $787,500, was paid January 31, 1906 and a third dividend, of the same amount, was paid April 30, 1906, apparently putting the common stock on a quarterly dividend basis, at the rate of 7% per annum.

The United Copper Co. is a securities holding corporation solely, and was organized along much the same lines as its former great rival, the Amalgamated Copper Co., but owing to the settlement of the war between the Amalgamated and the United Copper interests, in February, 1906, by the selling of the Heinze holdings to the Butte Coalition Mining Co., the status the United Copper Co. has been changed materially. The United Copper Co. began business as the owner of sundry stocks and bonds of various sub-

sidiary mining and holding corporations, as given in detail in Volume V, but through the selling of practically all of the holdings of these subsidiary companies, in the Butte camp, sundry readjustments have been necessitated. The price paid for the various Heinze holdings in Butte, by the Butte Coalition Mining Co., is said to have been $14,000,000 cash, but the United Copper Co. is a large shareholder in the Butte Coalition Mining Co., the stock of which has greatly appreciated in value, enhancing the holdings of the United Copper Co. accordingly. By the settlement of all litigation between the United and Amalgamated interests, a serious drain has been stopped, the cost of such litigation, for eight years past, having averaged more than $1,000,000 yearly. In May, 1906, the stockholders authorized the sale of $1,000,000 Montana Ore Purchasing Co. bonds and $2,500,000 Nipper Consolidated Copper Co. bonds, at par, to the Butte Coalition Mining Co. For 1905, the company showed a surplus of $370,087.

In addition to its holdings in the Butte Coalition Mining Co., the United Copper Co. controls, as subsidiary companies, the Basin Reduction Co., which concentrates the ores of the Butte Coalition Mining Co., and La France Copper Co., which holds the Lexington mine, in Butte, and is a producer therefrom of zinc and copper ores. Production by subsidiary companies, 1905, was 27,081,350 lbs. fine copper, but will be small for 1906, owing to sale of all of the principal mines, in February.

It is probable that the aggressive management of the United Copper Co., which has won its spurs in the field of finance by fighting a drawn battle with the Amalgamated and Standard Oil forces, will not remain content to continue existence merely as a coupon-clipping bureau, and it need not prove surprising if the company be heard from later, as a copper producer from fields other than Butte.

UNITED COPPER CO. **WASHINGTON.**

Office: 512-705 First Ave., Seattle, Wash. Mine office: Galena, Kittitas Co., Wash. Edward Peterson, president board of management. Organized under laws of Washington, with capitalization $2,000,000, shares $1 par. Lands, 310 acres, also a 60-acre millsite, well timbered, with available water power, on Camp creek, a branch of the Cle Elum river, in the Cle Elum district. Property shows 3 veins, carrying chalcocite and chalcopyrite, the main vein, of 50′ to 100′ estimated surface width, traceable 4 miles, carrying chalcopyrite, with a parallel vein and a cross vein carrying chalcocite. Development is by circa 1,800′ of tunnels, giving ore assaying up to 31% copper and $5 to $10 gold per ton.

UNITED COPPER-GOLD MINING & EXTRACTION CO. **ARIZONA.**

Still-born. Lands now held by Eagle Copper-Gold Mining & Milling Co.

UNITED COPPER MINING CO. **ARIZONA.**

Letter returned unclaimed from former office, 155 La Salle St., Chicago, Ills.

UNITED EMPIRE CO. **BRITISH COLUMBIA.**

Office: Bridgeport, Conn. Mine office: Princeton, Similkameen district, B. C. Dr. R. A. Lockhart, president; Wm. C. McDougall, vice-president and Canadian agent; Edwin L. Foster, secretary and treasurer. Organ-

ized 1904, under laws of Arizona with capitalization $500,000, shares $1 par. Lands, sundry claims, developed by shafts, a 125′ tunnel and numerous open-cuts, for a distance of circa 3,000′, on the strike of a vein of 50′ width, showing malachite and azurite, near surface. Ore is said to average $5 to $6 per ton and could be mined cheaply and in large quantities. The property carries a large bed of limestone, suitable for fluxing. Company is in litigation, original owners claiming a breach of contract, by which the purchasers failed to provide working capital, in the amounts and at the times agreed.

UNITED EXPLORATION CO. **WYOMING.**

Office: 113 Devonshire St., Boston, Mass. Supposed to have absorbed the Beulah Copper Co., of Wyoming. Apparently moribund.

UNITED GERMAN COPPER MINES, LTD. **GERMANY.**

Dissolved, September, 1904.

UNITED GLOBE MINES. **ARIZONA.**

Office: 99 John St., New York. Mine office: Globe, Gila Co., Ariz. James Douglas, president; George Notman, secretary and treasurer; Niles S. Berray, superintendent. Capitalization $2,300,000, shares $100 par. A large proportion of the stock issue is held by the Old Dominion Company. Paid a dividend of $6.50 per share, December 15, 1905.

Lands, 29 claims, lying next west of the Old Dominion group, also 3 millsites. Mine is extensively developed, having a 765′ three-compartment main shaft, showing an ore chute of 30′ width and 700′ length, carrying ore averaging 4% and upwards in copper, on the seventh level. Ore bodies are extensive, but erratic, and highly silicious, requiring heavy fluxing, and the mine is wet. Leasers formerly working on the property produced ores averaging 20% copper and 1 oz. to 15 oz. silver per ton, but the high-grade ore mined by the company averages circa 14% copper.

The mine has a 200-ton smelter, idle for some years, and is operated under a close working agreement with the Old Dominion mine, details of which arrangement are given in the description of the Old Dominion Company. To all practical intents and purpose, the United Globe now is a portion of the Old Dominion mine. Production 1905, is estimated at 7,000,000 lbs. fine copper.

UNITED GOLD & COPPER CO. **NEW MEXICO & CALIFORNIA.**

Dead. Letters returned from all former offices. Sold stock and paid dividends simultaneously, with the inevitable result. Fully described—and investors warned—in Vols IV and V.

UNITED GOLD & COPPER MINING CO. **COLORADO & NEW MEXICO.**

Dead. Was "regarded with suspicion" in Vol. V. Suspicions fully verified.

UNITED METALS SELLING CO. **NEW YORK.**

Office: 42 Broadway, New York. Works office: Perth Amboy, Middlesex Co., N. J. Adolph Lewisohn, president; Henry H. Rogers, vice-president; A. W. Evarts, secretary; Urban H. Broughton, treasurer and general manager; preceding officers, Wm. Rockefeller, Jesse Lewisohn and Frederick P. Olcott, directors. Organized January 29, 1900, under laws of New Jersey, with capitalization $5,000,000, shares $100 par. Dividends, since organ-

ization, have been as follows: 15% in 1900; 5% in 1901; 10% in 1902; 10% in 1903; 10% in 1904, and 20% in 1905. Company is controlled by large shareholders of the Amalgamated Copper Co., and is said to be considering an increase of capitalization.

The company does a general commission business in metals, the great bulk of its trade being in copper, of which it is the largest broker in the world, handling fully 600,000,000 pounds of copper yearly. The company is sales agent for the Amalgamated, North Butte, Osceola, Trimountain, Bingham Consolidated, Utah Consolidated, Arizona, Tamarack, and other smaller producers. Company owns and operates the Raritan Copper Works, at Perth Amboy, on New York harbor. This plant, completed 1899, is large and modern, doing a heavy business in refining blister copper electrolytically for the subsidiary companies of the Amalgamated Copper Co., and for various independent companies that sell their product through this agency.

UNITED MEXICAN MINING & SMELTING CO.

Stock in this corporation is being peddled by the notorious "Rev." C. E. Nylin, of the Laborers Co-operative Gold, Silver & Copper Mining Co. Anything that this larcenous minister of the gospel is connected with may be set down safely as a swindle.

UNITED MINES CO. **ARIZONA.**

Office: Globe, Gila Co., Ariz. Organized 1904, with capitalization $5,000,000?

UNITED MINING & DEVELOPMENT CO. OF AMERCIA. **CALIFORNIA & MEXICO.**

Office: 66 Broadway, New York. John Thompson, president; John R. Stanton, vice-president; Alfred W. Kiddle, secretary; E. F. Phelps, treasurer; Albert F. Freeman, general manager. Capitalization $10,000,000, shares $10 par, in $2,000,000 of 6% preferred and $8,000,000 common stock. Is a promotion and development company, formed to open and finance mines along much the same lines as the Venture Corporation of London. Holdings include 40 acres, known as the King Solomon mine, at Valley, Calaveras county, California, and the Nevada de las Miehes mine, 107 pertenencias, area 264 acres, in the Fuerte district of Sinaloa, Mexico. The California property has about 2,000′ of underground openings, giving assays of $12 to $15 per ton, in gold and copper. A little development also has been secured on the Sinaloa property.

UNITED RICO MINES CO. **COLORADO.**

Office: Denver, Colo. Mine office: Rico, Dolores Co., Colo. T. Walter Beam, president; John L. McNeill, vice-president; J. G. Moffat, second vice-president; Albert B. Roeder, secretary and treasurer; Percy S. Rider, superintendent: preceding officers, Daniel B. Ellis, J. W. Billuly and Thos. Keely, directors. Capitalization $3,600,000, shares $1 par, of which practically 75% was given for the stock of subsidiary companies. The United Rico Mines Co. controls, through stock ownership, the following named corporations: Rico Smelting & Refining Co., Colorado Milling & Concentrating Co., Rico Mining & Milling Co., Enterprise Mining Co., Rico-Aspen Mining Co.,

Black Hawk Mining Co., Rico Townsite Mining Co., Atlantic Cable Consolidated Mining Co., Security Mining Co., and several other properties. The various subsidiary companies were capitalized at about $15,000,000.

Lands, circa 200 claims, area 4,000 acres, including sundry millsites, smelter-sites, water-rights and 10 town lots. The mines have considerable development, collectively, and carry auriferous and argentiferous ores of copper, lead and zinc, greatest values being in the zinc. Equipment includes steam and electric power and a 20-stamp mill with 3 Huntington mills, 100-ton concentrator, 50-ton zinc mill and 100-ton smelter. Management seems good, and property should become a large producer of zinc, making considerable lead, copper, silver and gold, as by-products.

UNITED SOUTH AFRICA ASSOCIATION, LTD. **TRANSVAAL.**

Offices: 28, St. Swithin's Lane, London, E. C., Eng. Mine office: Brown's Bldgs., Loveday St., Johannesburg, Transvaal. Lord C. Montagu, chairman; W. Blelock and A. H. Oppenheim, general managers in South Africa; Minnett E. Frames, consulting engineer; D. H. W. Broad, secretary. Organized February 6, 1902, with capitalization £300,000, shares £1 par; issued, £253,100. Paid a 10% dividend, 1903, and a 15% dividend, 1905.

Lands, 568 claims on the Doornkop farm, a half-interest in 1,203 claims on the Klipportje farm, the Hollandia and Diamant Pan farms, and prospecting rights over sundry other farms, with options on 16 farms, area 50,000 morgen, on the border of the Middelburg and Waterburg districts, latter carrying copper in a 250′ shaft.

UNITED SPANISH COPPER MINES, LTD. **SPAIN.**

Voluntarily wound up, February, 1901.

UNITED STATES GOLD & COPPER CO. **WASHINGTON.**

Letter returned unclaimed from former office, Seattle, Wash. Mine office: Chewelah, Stevens Co., Wash. Lands, sundry claims, slightly developed, said to show promising copper ore. Early in 1906 was under bond and lease to George C. Robbins, said to represent eastern capital.

UNITED STATES GOLD INCORPORATION. **COLORADO**

Mine office: Eldora, Boulder Co., Colo. John F. Rowell, general manager, at last accounts. Lands, 300 acres, in the Arapahoe copper-gold belt.

UNITED STATES & GUERRERO EXPLORATION CO. **MEXICO.**

Office: Ashland, Ky. Dr. J. Letton Martin, president. Capitalization, $1,000,000. Lands, 148 acres, in the states of Michoacán and Guerrero, Mexico, former holdings being near the Inguarán. Idle.

UNITED STATES & MEXICAN MINING CO. **MEXICO.**

Office: 42 Murray St., New York. Mine office: Hostotipaquillo, Jalisco, Mexico. Isaac P. Martin, manager. Lands include the Trinidad and Guadalupe mines, carrying auriferous and argentiferous copper and lead sulphides.

UNITED STATES MINE. **ARIZONA.**

Mine office: Globe, Gila Co., Ariz. Adolph Lund, owner. Lands, sundry claims, adjoining Old Dominion, on the west side of Pinal creek, opened by a 100′ three-compartment shaft, planned to be sunk to depth of 1,000′.

UNITED STATES MINING CO. **UTAH.**

Offices: 50 Congress St., Boston, Mass. and 508 Dooly Blk., Salt Lake City, Utah. Mine offices: Bingham Canyon, Salt Lake Co., Utah, and Tintic, Juab Co., Utah. Employs 1,331 men. Wm. G. Sharp, president; Wm. F. Coolidge, vice-president; F. Winthrop Batchelder, secretary and treasurer; Albert F. Holden, managing director; preceding officers, R. D. Evans, Eugene N. Foss, N. W. Rice, E. C. Swift, J. J. Storrow and Sidney W. Winslow, directors; Hon. C. E. Allen, general manager; A. P. Maybury, mine superintendent at Bingham; R. A. Brown, mine superintendent at Tintic; Richard E. Parker, consulting engineer; Percy Williams, engineer; Aron Hirsch & Sohn, sales agents.

Organized 1899, and reorganized 1901, under laws of Maine, with capitalization $15,000,000, shares $25 par; issued, $14,000,000. Debentures, $500,000, due May, 1909. Dividends of 50 cents per share were paid July, 1904, and February, 1905. Net earnings for fiscal year ending June 30, 1905, were $1,092,987. The United States Mining Co. owns the entire capital stock of the United States Smelting Co., owns substantially all of the capital stock of Centennial-Eureka Mining Co., operating mines at Tintic, and owns a ⅔ interest in the DeLamar copper refinery at Chrome, New Jersey. In turn the United States Smelting Co. is controlled by the United States Smelting, Refining & Mining Co., which, in January, 1906, owned 98% of the stock of the United States Mining Co., obtained through exchange of shares, with a cash bonus. Wm. F. Moller, transfer agent. National Shawmut Bank, Boston, registrar. Annual meeting, in October.

The mines of the company are in two groups, one at Bingham and one at Tintic. The properties at Bingham, which were the original holdings of the company, include the Old Jordan, Telegraph, Niagara, Commercial and adjoining claims. The Niagara, which apparently is of the least importance, is held through a stock interest, and minority stockholders fomented litigation, which was settled favorably to the United States company, November, 1904. The Old Jordan and Telegraph were originally silver mines, opened on a fissure vein of silver-lead ore crossing the big sulphide copper dyke from which the present production is secured. The copper ores are silicious and deficient in iron, requiring heavy fluxing, and range in tenor from 1.5% to 2% copper, with 2 oz. to 5 oz. silver and $1 to $2.50 gold per ton. The Old Jordan and Telegraph ores are said to be giving smelter returns of 26 to 28 lbs. copper and $2 to $2.50 gold and silver per ton. The deepest workings at Bingham are about 400′ only, with about 5 miles of openings on the Old Jordan group, developing a large amount of ore. The Galena mine, now being reopened, is developed to a depth of 235′ and produced upwards of $1,000,000 under previous ownership, the record showing average smelter returns of 20% lead, 25 oz. silver and up to $10 gold per ton. The aerial tramway, taking the ore from mines to railway, has a capacity of 25 tons per hour. Litigation over the Old Jordan was settled favorably to the company, in 1905.

The Tintic group includes the Centennial-Eureka and Tintic mines, control of the Centennial-Eureka, which was a large dividend-payer in

the past, being held through ownership of all but about 100 shares of the capital stock. The Tintic properties are old mines, producing ore of two grades, the oxides and carbonates carrying high values in gold and silver and ranging from $10 to $30 per ton in value. The low-grade copper deposits are of enormous extent, but carry only small gold and silver values. The main shaft, 1,500′ deep, shows good values on the bottom level. The Centennial-Eureka was examined, early in 1905, by J. Parke Channing, a conservative and fully competent authority, who found reserves of 600,000 tons of ore, carrying average values of $11.88 per ton. Several patented claims adjoining the Centennial-Eureka were purchased in 1905.

The various mines of the United States company have about 2,000,000 tons of ore blocked out for stoping, of which about 90% is low-grade, this being sufficient for about 5 years requirements. The mines are well equipped with hoisting and other machinery.

In addition to its metalliferous mines the company owns a large limestone quarry and iron mines, supplying flux, and has coal mines supplying fuel. The coal mines employ 185 men and a coking plant attached employs 55 men. The advantages pertaining to complete ownership of ores, fluxes, fuel and smelter are very great, and place the company in an impregnable position as a producer.

The smelter is operated by the United States Smelting Co., and is described under that title.

Production, for the calendar year 1905, was 15,841,667 lbs. fine copper, and for the year ending Oct. 1, 1905, the smelter produced 14,965,438 lbs. fine copper, 10,200,826 lbs. fine lead, 2,107,956 oz. fine silver and 71,445 oz. fine gold, production being valued at approximately $5,300,000. Early in 1906 the Centennial-Eureka was producing circa 8,500 tons monthly, and the Bingham mines about 15,000 tons monthly, in addition to which circa 2,500 tons of custom ore were purchased monthly by the United States Smelting Co.

UNITED STATES MINING & SMELTING CO. **MEXICO.**

Dead. A Henry Voorce Brandenburg promotion. Described in Vol. V.

UNITED STATES & NICARAGUA CO. **NICARAGUA.**

Office: 345 Fourth Ave., Pittsburg, Pa. R. S. Smith, president; M. K. Salsbury, vice-president; Wm. Rees, secretary and treasurer. Organized Apr. 20, 1903, under laws of Maine, with capitalization $1,000,000, shares $100 par. Property is an exclusive government concession for mining, covering the two northern states of Chinandega and Segvoia, in the republic of Nicaragua.

UNITED STATES REDUCTION & REFINING CO. **COLORADO.**

Office: 54 Wall St., New York. Works office: Colorado Springs, El Paso Co., Colo. Chas. L. Tutt, president; Chas. N. MacNeill, first vice-president and manager; Spencer Penrose, secretary and treasurer. Organized May 31, 1901, under laws of New Jersey, with capitalization $10,000,000, in $4,000,000 non-cumulative 6% preferred and $6,000,000 common stock. Debentures, $3,000,000. In November, 1905, had a sinking fund of $300,000, for bond redemption, and is supposed to have received $1,000,000

, for stock of the Utah Copper Co., sold to the American Smelters Secur- Co., which probably will be added to the sinking fund. Regular divi- l rate, 1902–1903, was 1½ quarterly on preferred, and 1% quarterly ommon stock.

Property includes extensive reduction plants, at Colorado City, Florence Canyon City, Colorado, treating mainly ores from the Cripple Creek district.

ITED STATES SMELTING CO. **MEXICO.**

Organized under laws of Arizona, with capitalization $1,000,000, shares cents par. Lands, supposedly circa 30 acres, undeveloped, in the Ures trict, Sonora, Mexico. Apparently is merely a stock-jobbing enterprise.

ITED STATES SMELTING CO. **UTAH.**

Offices: 50 Congress St., Boston, Mass., and 508 Dooly Blk., Salt Lake y, Utah. Works office: West Jordan, Salt Lake Co., Utah. General icers are practically the same as those of the United States Mining Co., ich owns the entire capital stock of the United States Smelting Co. F. Holden, managing director; Hon. C. E. Allen, general manager; S. C. eltine, superintendent; H. C. Bellinger, consulting metallurgist; T. R. es, manager custom ore department.

The smelter, occupying a 150-acre site, near the works of the Utah nsolidated and Bingham Consolidated, is 12 miles from Bingham and 80 les from Tintic, where the mines of the United States Mining Co. are ated. The plant includes 2 sampling mills, with a third under construction.

The smelter has a present daily capacity of 1,200 tons of copper ore d 300 tons of lead ore, equipment including six 200-ton water-jacket blast- naces for copper, three 100-ton water-jacket blast-furnaces for lead, 10 nd-roasters and one 125-ton reverberatory furnace, with 5 additional sters building for the lead plant. The lead smelter was built 1904, and obably will be doubled in capacity. Pyritic smelting of raw ore was em- oyed originally, in the copper stacks, but has been abandoned. Flux r the silicious Bingham ores is furnished by an iron mine owned by the nited States Mining Co. The copper converter has 2 stands, with electric aveling cranes, and the works include a briquetting plant for fines and ue-dust, silica-mill and an electric light plant. The works do a general stom business, besides smelting ores of the United States Mining Co. onsiderable trouble has been caused by smelter fumes, but these have been ssened, and the amount of flue-dust cut down, by sundry changes in the nelting practice.

NITED STATES SMELTING, REFINING & MINING CO. **UNITED STATES & MEXICO.**

Office: 50 Congress St., Boston, Mass. Operating office: 508 Dooly lk., Salt Lake City, Utah. Wm. G. Sharp, president; F. W. Batchelder, ecretary and treasurer; A. F. Holden, managing director; preceding officers, rederick Ayer, William Barbour, Charles F. Brooker, William H. Co lge, R. D. Evans, Eugene N. Foss, C. A. Hight, N. W. Rice, Galen L. St ames J. Storrow E. C. Swift, H. H. Wehrane, and Sidney W. Win irectors.

Organized January 10, 1906, under laws of Maine, with capitalization $75,000,000, shares $50 par, in $37,500,000 preferred 7% cumulative shares and $37,500,000 common shares. Quarterly dividends of 1¾% on the preferred shares are payable January, April, July and October, first dividend having been paid April 15, 1906. City Trust Co., Boston, transfer agent. National Shawmut Bank, Boston, registrar. Annual meeting, in May.

The company sold 150,000 shares of stock at par, $50, less $4 paid the underwriting syndicate, and with the proceeds has acquired control of a number of important mining companies, being a securities holding corporation solely, modeled along lines somewhat similar to the Amalgamated Copper Co. and the American Smelting & Refining Co., apparently being planned eventually to become a strong competitor of the latter-named corporation, generally known as the smelter trust.

The United States Smelting, Refining & Mining Co. owns more than 99% of the capital stock of the United States Mining Co., having given therefor share for share, ¾ in preferred and ¼ in common stock, plus $1 per share cash bonus. The company also owns upwards of 90% of the capital stock of the Compañía Minera Real del Monte y Pachuca, owning a valuable silver-lead mine in the state of Chihuahua, Mexico. The company controls, through stock ownership, the Eureka-Richmond Mining Co. and the American Exploration Co. The company also controls, either directly or through stock ownership by the United States Mining Co., the Mammoth Copper Mining Co., of California, and also owns a large interest in DeLamar's Copper Refining Co. The various subsidiary companies named are described under their respective titles.

UNITED SULPHUR, COPPER & IRON CO.

Organized August, 1905, under laws of New Jersey, with capitalization $12,000,000.

UNITED VERDE COPPER CO. **ARIZONA.**

Office: 49 Wall St., New York. Mine office: Jerome, Yavapai Co., Ariz. Employs circa 1,100 men. Hon. William A. Clark, president; James A. Macdonald, vice-president; Pierre V. C. Miller, secretary and treasurer; Chas. W. Clark, general manager; preceding officers and James Kitchen, directors; W. L. Clark, assistant superintendent; Otto Strodhoff, chief clerk; Geo. Bosch, master mechanic. Organized September 2, 1899, under laws of West Virginia, with capitalization $3,000,000, shares $10 par, as reconstruction of a company of same title, organized under laws of New York. Debentures, $3,000,000 income bonds authorized; $2,998,800 issued, payable 1949. Annual meeting, third Monday in February. Is conducted as a close corporation, Senator Clark being supposed to own circa 90% of the capital stock.

Dividend payments were begun, 1892, on the basis of 25 cents per share monthly, increased, 1896, to 50 cents per share monthly, and again increased, 1898, to $1 per share, monthly, maximum dividends being $4,498,680, in 1899, in which year the net earnings were $5,435,970. In 1904 the company paid 7 dividends of 75 cents each, aggregating $5.25 per share, and in 1905 there were 9 dividends of 75 cents each, aggregating $6.75 per share.

Lands, 13 claims, area 230 acres, with sundry adjoining lands, in the Verde district of the Black Hills range, at an elevation of 5,600′ above sea-level and 1,800′ above the valley of the Verde river. The United Verde was a small gold and silver mine, until bought, 1888, by Senator Clark. The mine is in a zone of slates and intrusive dioritic rocks, the neighboring limestone being unconformably superimposed, and apparently having no connection with the ore deposits. The mine is opened on a single monstrous lense of sulphide ore, of 600′ extreme width and circa 1,900′ length, in slate, the lense having a dip of 72°, and being intruded by a 70′ quartzite dyke carrying about 1% copper and 1 oz. to 13 oz. gold per ton, ore from which is used for converter linings. The gossan outcrop, carrying auriferous and argentiferous oxide and carbonate ores, to a depth of circa 160′, has been worked out. The zone of secondary enrichment carries mainly chalcocite, with some covellite and other alteration minerals of copper, all highly argentiferous The unaltered ores, mainly chalcopyrite, with a little bornite, are both auriferous and argentiferous. In mining no assortment is made and no concentration attempted, everything from the mine openings going to the furnaces, the average of the ore taken from the openings being circa 6.5% copper and 15% to 32% sulphur.

Access to the mine is secured with extreme difficulty, and only upon a written order from Senator Clark, such orders being very uncommon, and employes are cautioned against giving out information. Underground openings are very extensive, with enormous ore reserves, estimates of ore in sight varying greatly, and ranging up to 20,000,000 tons, which is much too high. Mine is developed above the 900′ level, diamond drill borings showing ore to a depth of 2,000′. It is not known that the ore is leaner at that depth, but in all likelihood such is the case. The mine is worked pillar-and-stall, and timber, when used, is placed as square sets. Worked-out stopes are filled with culls, and occasionally with barren rock blasted from the mountain side above the mine, and milled into the abandoned stopes, a practice regarded as dangerous.

Owing to its richness in sulphur the ore is very heating, and liable to spontaneous combustion, hence a sharp watch is kept for fires, which are extinguished at their inception, when possible, or otherwise walled in by solid concrete bulkheads. Owing to the more or less shattered condition of the lense, it is difficult entirely to prevent access of air, very little of which will keep a fire burning indefinitely in an ore so rich in sulphur as that of the United Verde. The most serious outbreak of fire was in August, 1902, causing a total suspension of mining. The fire was finally gotten under control by pumping the mine full of carbonic acid gas, this being made by treating crushed limestone with dilute sulphuric acid, in iron tanks, gas being forced by natural pressure into the top of the shaft, whence it fell by gravity to the bottom of the mine, displacing the lighter atmospheric air. The fire on the 400′ level has been burning since 1897, and although its progress is cut off as much as possible, by bulkheads, has eaten its way, slowly but steadily, to the 700′ level, at the bottom of the mine. Fire, however, while dangerous and annoying, cannot burn

up the copper, all of which will be recovered, eventually. The mine is subject to bad caves, one of which carried down the office building and killed a number of employes, some years ago. From a miner's standpoint the United Verde is not an especially desirable working-place, as the openings are very hot and the acid waters cause blisters and sores upon the unprotected skin, while the mine fires and caving ground render underground work more or less dangerous. Efforts have been made to render the mine safer, but, owing to its having been opened wrongly at the start, these are not entirely successful, though considerable improvement has been secured. Owing to the fires and caves, the shafts sunk in ore are subject to drawing, causing their ultimate abandonment, hence all new shafts are sunk in the country rock. The timbering of the mine has been much bettered latterly, and the mine, while by no means an ideal working-place for persons of weak nerves, is much safer than formerly.

In April, 1905, a serious explosion killed 5 men, and for a time threatened the entire mine. The fire had eaten its way to a point below the 700′ level, and a cave on this level, caused by the fire, fissured the superincumbent rock-mass so that surface-waters from the heavy spring rains seeped down into the fire zone, generating steam that blew out the solid masonry bulkheads and endangered the lives of the miners by steam and sulphur fumes—a truly diabolical combination. In fact the explosion at the United Verde might be termed an artificial volcano, just as the "air-blasts" at the Quincy and Atlantic mines, in the Lake Superior district, are called artificial earthquakes. The caving ground followed by the explosion caused the surface to settle in May, 1905, but this trouble proved less serious than was first feared, and production was suspended for 48 hours only.

The manner in which the fire is being fought and conquered is very simple, yet highly ingenious, credit for the plan being due to Mr. J. J. Shaw. The Hampton stope, in the fire zone, idle since 1901, is being mined out, with the aid of compressed air. The air feeds the fire, which is a smouldering one, but drives back the deadly fumes and permits the miners to work. This new use for compressed air doubtless will be adopted at other sulphide mines having similar trouble from fire.

The old main shaft, 6x18′ in size and 800′ deep, has a 700-h. p. hoist, good for 2,000′ depth, operating two 3-ton double-deck cages. A new 5-compartment shaft, 900′ from the old main shaft, 900′ deep, was located to sink continuously in country rock, but cut ore at 600′ depth and has held it to the bottom, considerably extending the known ore limits of the mine. The new main shaft has 4 cages, worked in counterbalance. Electric traction is used for underground haulage.

The surface plant and smelter are on top of the mine, the precipitous walls of the cañon rendering such a location obligatory, when the mine was opened. A new compound air-compressor, ordered for 1906 delivery, will have steam cylinders of 28″ and 52″ diameter, with 48″ stroke, and air-cylinders of 26″ and 44″ diameter, with capacity to compress 6,000 cubic feet of free air per minute to a pressure of 70 lbs. per square inch, at 75 revolutions per min-

ute. Coal was used for fuel, but has been replaced largely by petroleum, the coal being of uncertain supply, as well as inferior in grade. A 178,000-gallon storage tank holds the reserve supply of petroleum. Water is received through pipes, but the supply is somewhat scanty, and the precious fluid is husbanded with care. Water from the mine is leached over scrap-iron, in cementation tanks, near the smelter, and the copper in solution recovered as precipitate. Wood for the roast-heaps is inferior, but costs $8 per cord, and coke for the smelter costs $12 to $15 per ton, and is in rather uncertain supply. Electric light and power are furnished by a dynamo driven by 350-h. p. engine.

All ore above 12% in copper tenor is sent direct to the smelter, the balance being trammed through a 1,300′ tunnel, on the 500′ level, to the roast-yard, where the ore is heap-roasted with cordwood, on contract, each 500-ton heap requiring 5 to 9 weeks for roasting. When roasted, the ore is trammed back into the mine through the tunnel, and hoisted through the shafts to the smelter, the exceedingly precipitous nature of the ground rendering it impracticable to secure direct connection between the smelter and roast-yard, except through the mine. The smelter was practically rebuilt in 1903, while in blast. Equipment includes one 250-ton and three 500-ton blast furnaces, one of the larger furnaces being kept in reserve as a spare, one reverberatory furnace for smelting flue-dust, fines and ores exceptionally rich in the precious metals, and a small tilting furnace for casting anodes. The converter department has 6 stands and 15 shells, with two 50-ton traveling cranes. The smelter stack has a screen-top, to catch flue-dust, which carries high values in gold and silver. Anodes are shipped for refining mainly to the Waclark Wire Works, at Elizabeth, New Jersey, where the gold and silver are parted, and the copper used principally for drawing into wire.

The United Verde & Pacific railroad, a 28-mile narrow-gauge line, connects the mine with the Santa Fé, Phœnix & Prescott railroad, at Jerome Junction, this line traversing very difficult country. Underground employes work 8-hour shifts, and such as wish it are furnished rooms at $5 per month, and table board at $7 per week, in a fine hotel built by Senator Clark.

Production, 1905, was approximately 33,000,000 bs. fine copper, as against 29,500,000 lbs. in 1904, comparing with the largest production, 43,995,932 lbs., in 1899. Dividends for 1904 and 1905, on a total output of 62,500,000 lbs. fine copper, aggregated $3,600,000, being nearly, but not quite, 6 cents per pound of copper made. There were heavy outlays for improvements, which, charged direct to operating expenses, raised the cost of production, which probably was nearer 9 cents per pound than 8 cents, for the average of the two years, but the cost should be reduced to 7 cents, or possibly less, with improvements completed and the mine working under normal circumstances. In earlier years, applying contained gold and silver toward reduction of cost of copper, latter has been made for 5 cents per pound, and possibly, in one years, for even less, but these figures of cost do not seem likely to be duplicated in the future. The stories, so long and widely current, that the United Verde makes copper for nothing, the gold and silver values defraying all costs, never were true but are likely to do service in the press

and in the prospectuses of new mining corporations, more anxious for cash than truth, for many years to come. The Unite Verde is one of the largest and richest among mines, but there are other mines making cheaper copper.

UNITED VERDE EXTENSION MINING CO. **ARIZONA.**

Mine office: Jerome, Yavapai Co., Ariz. N. L. Amster and S. H. Probert, consulting engineers; B. L. Jones, superintendent, at last accounts. Organized 1894, under laws of Arizona, with capitalization $3,000,000, shares $10 par, and apparently was reorganized, circa 1905, under laws of Maine. Lands, 4 claims, area 75 acres, adjoining the United Verde. Early work on the Jerome property proving unsuccessful, the promoter committed suicide, and the company later took over the Red Rock mine, near Providence, Yavapai county, Arizona, which apparently has been lost or disposed of. The company is said to be free from debt, and to plan exploring its Jerome claims by diamond drill.

UNITED VERDE JUNIOR COPPER CO. **ARIZONA.**

Disappeared utterly. A mere stock-jobbing scheme, of the 1899 copper boom, promoted by Benj. F. Peach and Edwin Wallace.

UNITED VERDE JUNIOR COPPER MINING CO. **ARIZONA.**

Dead. Possibly same as the United Verde Junior Copper Co.

UNITED VERDE SYNDICATE, LTD. **BRITISH COLUMBIA.**

Office: care of S. E. Ceperly, Vancouver, B. C. Lands, 6 claims, area 240 acres, 5 miles from the proposed line of the Yukon railroad, 40 miles from Howe Sound, on Fitzimmons Creek, British Columbia, showing large bodies of heavily mineralized schist, carrying 1.5% to 9% copper and $2.84 gold per ton, with a little silver. Property cannot be operated to advantage until rail connections are secured.

UNITY COPPER & GOLD MINING CO. **NEW MEXICO.**

Mine office: Tres Piedras, Taos Co., N. M. Lands, 12 claims, in the Bromide district, claimed to have considerable development and said to give a fair showing of auriferous chalcopyrite, bornite and tetrahedrite. Idle.

UNIVERSAL COPPER MINING CORPORATION, LTD. **MEXICO.**

Offices: 31, Lombard St., London, E. C., Eng. F. Richards, secretary. Organized Dec. 21, 1896, with capitalization £40,000, shares £1 par; issued, £9,476. Said to own interests in Mexico, but location not discovered.

SOCIEDAD MINERA UPOLONGOS. **ARGENTINA.**

Presumably wound up. Lands now held by Famatina Development Corporation, Ltd.

UREA MINING CO. **MEXICO.**

Letter returned unclaimed from former mine office, Velardeña Dgo., Mex.

UTAH-APEX MINING CO. **UTAH.**

Offices: 53 Tremont St., Boston, Mass., and 306 Auerbach Blk., Salt Lake City, Utah. Mine office: Bingham Canyon, Salt Lake Co., Utah. Employs circa 50 men. E. R. Hastings, president; Frank A. Schirmer, vice-president; Joseph J. Bedlow, secretary; John W. Horne, treasurer; preceding officers, Chas. A. Morse, Henry R. Bradley, Albert J. Orem and Wm. J. Carlin, directors; Parrington M. McCree, superintendent; Arthur L. Pearse,

lting engineer. Organized May, 1902, under laws of Maine, with alization $2,500,000, shares $5 par. The directors have asked the holders to authorize a 10-year 5% bond issue of $500,000, convertible stock at par, of which $100,000 is to be used for building railroad spur tramway, and the installation of a compressor plant, and balance for ing capital and further improvements. Annual meeting second Tues- in September. Federal Trust Company, Boston, registrar.

Lands, 24 claims, area 162 acres, in Carr Fork, adjoining the Utah olidated, location being considered excellent. Property originally was New York and Copperfield groups, to which the Dana, Peter and High- Boy Consolidated groups have been added. These various properties produced 300,000 tons of ore, including chalcopyrite and lead onates and sulphides. Ores carry an excess of iron, giving low smelting ges, because of premium paid for each excess unit of iron, by the Utah ers. The net average of 86 shipments, made by the present company, gross values of circa $9.50 per ton, averaging 2.5% copper, with fair and silver values.

Development is by 3 shafts, with upwards of 4 miles of underground ings, the principal openings being the Andy tunnel, which was showing oved ground, early in 1906, and the Parvenu tunnel, 1,200' long, which tually will cut the main vein, giving a back of 1,000' to 1,500', and which be connected with the upper workings, becoming the main working tunnel. The mines are said to show reserves of about 250,000 tons of 2.5% copper and about 40,000 tons of $15 lead ore. Production has been hampered, he past, by the necessity of shipping ore by wagon, over rough mountain ls, but this will be remedied by building a 2,200' aerial tram, with a of 700', from the portal of the Andy tunnel to the portal of the Parvenu el, and the construction of a 2,300' railway spur from the mouth of the venu tunnel to the Copper Belt railroad. A 15-drill air-compressor be installed, and the company plans building a concentrator. If the venu tunnel strikes the ore body, as is reasonably certain, the Utah-Apex uld make a good mine.

AH & BOSTON COPPER CO. UTAH.

Dead. Property sold, circa 1902, to pay debts.

AH CONSOLIDATED GOLD MINES, LTD. UTAH.

Reorganized, 1902, as Utah Consolidated Mining Co.

AH CONSOLIDATED MINING CO. UTAH.

Office: 42 Broadway, New York. Mine office: Bingham Canyon, t Lake Co., Utah. Works office: Murray, Salt Lake Co., Utah. Urban Broughton, president; Adolph Lewisohn, Hermann, nd vice-president; preceding officers, Jam N. King, rectors; F. P. Addicks, secretary and tre general nager; W. R. Smith, general superin land perintendent; N. B. Rossorla, mine supe ller perintendent; Geo. K. Fisher, consulting min echanical engineer.

Organized 1903, under laws of New Jersey, with capitalization $1,500,000, shares $5 par, as a reconstruction of the Utah Consolidated Gold Mines, Ltd., a British corporation that in turn succeeded the Sevier Gold Mines, Ltd., in October, 1896. Property of the Utah Consolidated Mining Co. is 2,490 shares of the 2,500 shares of capital stock of the Highland Boy Gold Mining Co., of New Jersey, latter corporation holding direct title to the Utah properties. About 20% only of the capital stock is held in Great Britain. Dividends of the present company and its predecessor were $732,000 in 1901, nothing in 1902, $900,000 each in 1903 and 1904, and $1,050,000 in 1905. First semi-annual dividend of 1906 was $2.50, amounting to $750,000. For 1905, gross earnings were $3,478,266, and net earnings were $1,887,385.

Lands, 239 acres, known as the Highland Boy group, in Carr Fork Gulch, Bingham division of the West Mountain district, about 2½ miles from Bingham Canyon. The ores are sulphides, occurring in chutes running 2% to 13% copper, with average values of $2.50 to $3 gold and silver per ton, the average ores carrying about 30% each of iron, silica, and sulphur, rendering them self-fluxing. There are 6 distinct ore bodies, with 3 main ore chutes developed, largest being approximately 220′ in extreme width by 340′ length, opened to depth of 400′. The Highland Boy is opened by one shaft of 900′ and 6 tunnels, extraction being through tunnels, No. 7, the lowest tunnel, being 700′ below the crest of the mountain. All tunnels are connected, and ore is milled down to the bottom tunnel for removal, tunnels being 1,000′ to 2,500′ in length. Ore extraction is by the top slice caving system and square set timbering is used, culls being used for filling. Miners work on contract mainly. The entire underground system smacks strongly of Lake Superior iron ore methods. The chutes apparently are somewhat smaller in the bottom levels, but carry good values and are likely to continue workable to great depth. Ore reserves, at the end of 1905, were estimated at 1,100,000 tons of sulphides, and in addition there are about 300,000 tons of low grade oxidized ores, not taken into account by the management. New mine openings, 1905, were 12,444′ and the year was ended with circa 12 miles of underground workings.

Owing to extraction by tunnel, the mining plant is not extensive, but is ample for all requirements, electric power being utilized for traction and other purposes. Ore is carried from the portal of No. 7 tunnel by a 12,700′ aerial tram, leading to ore-bins beside the track of the Rio Grande Western railway. There also is a subsidiary aerial tram crossing Carr Fork Cañon, used in handling lumber and mining supplies

The 500-ton Highland Boy concentrator has 18 Frue vanners, 36 Wilfley tables and 2 Wilfley slimers.

The 800-ton smelter, at Murray, 10 miles south of Salt Lake City and 17 miles north of the mine, has 20 McDougall calciners, 3 Wethey calcining furnaces and 9 reverberatory furnaces, two of the latter being 17′x43′ 6″. Power is furnished by a 450-h. p. Nordberg tandem-compound steam engine and a 250-kw. Westinghouse electric generator. A dust-chamber, 27x56x18′, has steel hopper bottoms, and the converter plant has a 190′ stack 5′ 6″ in diameter. The ores give clean slags, and the plant gives excellent results, turning out 99%

blister copper. Smelting costs are exceptionally low. Considerable trouble has been had with the agricultural interests adjoining, through actual damages caused, and even greater damages claimed, from sulphur fumes. Experiments have been conducted in liquefying the fumes, and it is likely that an acid plant will be added, giving the company an added revenue from a valuable by-product, formerly lost.

Production, 1905, was 287,148 tons of ore, of which 286,363 tons, or practically all, was sulphide copper ore, yielding 17,264,474 lbs. fine copper, 374,685 oz. fine silver and 28,290 oz. fine gold, giving an average yield of 3% copper, 1.3 oz. silver and 0.1 oz. gold per ton. Mining expenses were $444,331.74, or $1.55 per ton, and smelting and transportation charges were $647,996.89, or $2.25 per ton, while total costs of all kinds aggregated $1,313,022.75, or $4.57 per ton. Net cost of copper, 1905, was 7.6 cents per pound. The Utah is a fine mine, with a most excellent management, and is capable of a considerably large output than has yet been secured.

UTAH COPPER CO. **UTAH.**

Office: 604 McCornick Bldg., Salt Lake City, Utah. Mine office: Bingham Canyon, Salt Lake Co., Utah. Employs 225 men. Chas. M. MacNeill, president: Daniel C. Jackling, vice-president, general manager and chairman excutive committee; Spencer Penrose, secretary and treasurer; preceding officers, Col. Enos A. Wall, J. D. Hawkins and Kenneth K. McLaren, directors; Robt. C. Gemmell, general superintendent; John McDonald, mine superintendent; Frank G. Janney, mill superintendent; G. O. Bradley, mechanical engineer; J. C. Dick, mining engineer; John Hays Hammond, consulting engineer.

Organized April 30, 1904, under laws of New Jersey, with capitalization $4,500,000, shares $10 par Has been authorized to increase capitalization to $6,000,000, the new stock issue of $1,500,000 par value to remain in the treasury, for redemption of an authorized bond issue of $3,000,000, at 6%, of which $600,000 has been issued, in denominatons of $1,000, convertible in 5 years, at option of holder, into stock, at $20, or twice par. A bond issue of $750,000 at 7% has been partially retired by the new bonds at 6%. and balance of new bonds will be used for the construction of additional milling facilities. The American Smelters Securities Co. has a large share interest in the Utah Copper Co. Annual meeting, fourth Friday in January. Morton Trust Company, New York, registrar.

Lands, 18 claims, area 200 acres, with 3,000 acres in mill and smelter sites, the mining lands, bought of the DeLamar-Wall Mining & Milling Co., lying on both sides of Bingham Canyon, permitting ore extraction by tunnel, to great depth. Country rocks are porphyry and quartzite, the ore body being monzonite, an altered, decomposed, friable porphyry that breaks easily, yet stands well, giving timbering costs of less than 2 cents per ton of ore mined. Ore is chalcopyrite, quite evenly disseminated throughout the porphyry, with occasional veinlets carrying high-grade chalcocite and bornite. The porphyritic ore runs 0.75% to 2.75%, and the average assay of 6,000 samples is 1.98% copper, 0.15 oz. silver and

0.016 oz. gold per ton, which is practically identical with the average of the ore milled.

Considerable diamond drilling has been done, from the main tunnel, to depths of 400′ to 500′, proving a continuance of the ore body, practically unaltered, to those depths. The ore measures of the Utah Copper Co. are a continuation of the monzonite ore body of the Boston Consolidated, which is one of the greatest in the world, there being an area of approximately 2,000x3,000′ carrying ore having a known depth of 500′, without barren rock yet encountered at any point, by tunnels or bore-holes. The mine has blocked out, above the main tunnel level, about 25,000,000 tons of ore.

Owing to the altogether unusual nature of the ore body, the Utah is essentially a quarrying proposition, like the Rio Tinto and Granby. The plan of development is unique, and is adaptable only to a property of this most unusual nature. Mine openings are rectangular, laid out like the streets of a city, with blocks above blocks, like the successive floors of a building. There are 13 tunnels, entering the hills at approximately right angles to the gulch. These tunnels are avenues, and crossing the avenues, at right angles, parallel with the gulch, are streets, these being opened 150′ apart. Paralleling the tunnels, or avenues, are drifts, corresponding to alleys in the cities, these being 75′ from the avenues, on either side. The tunnels are 10x10′, or larger, and all openings are of exceptionally large dimensions, connections between the various floors being secured by upraises from alley to alley. The avenues, streets and alleys are named on the same system as is used in the street nomenclature of Salt Lake City. In all, 12 miles of avenues, streets and alleys had been opened, to the end of 1905.

The main working tunnel has a double tram-track, laid with 30-lb. rails. Stope levels are opened at intervals of 17′ and 25′. The mine is to be operated by the caving system, and also by open-pit work, and a steam shovel was bought, early in 1906.

The mine has a 125-h. p. steam plant, air-compressor, 18 power drills and an electric haulage system.

The first concentrator, of 1,000 tons daily capacity, costing about $300,000, was so planned that it could be increased, by units, to circa 6,000 tons, ultimately. Development at the mine rendering it probable that this capacity would be insufficient, a new mill-site has been secured, of sufficient size to permit unlimited development. The first concentrator, in Bingham Canyon, near the mine and 1½ miles below Bingham, receives ore over a spur of the Bingham branch of the Rio Grande railway, the railroad track entering the mill over a trestle, ore being dumped into bins beneath the track. The building is 193x327′ in size, built of wood and sheathed with iron. Equipment includes 2 Gates centrifugal crushers, 4 sets of rolls, 6 Hartz jigs, 32 Wilfley tables, 2 Overstrom tables, 2 Card tables, 52 slime tables, 6 Chilean mills, 18 six-foot Frue vanners, 6 hydraulic classifiers, 6 revolving screens, and settlers. Ore is drawn from the bins, through chutes, to a 200′ belt-conveyor, which carries the ore to the crushers. The crushing department, 26x44′, has two 1,200-ton Gates crushers, and two sets of 36″ and 30″ Gates

The boiler house, 36x100′, has eight 75-h. p. tubular boilers, with matic stokers, and 125-h. p., 150-h. p. and 350-h. p. engines.

he new mill is located on a 3,000-acre millsite, near Garfield Beach r, Great Salt Lake, the site being 10 miles north of Bingham, and 4 miles the new Garfield smelter of the American Smelting & Refining Co. laltair property has several good springs, one with a flow of 3,000 gallons inute, giving water supply adequate for a 3,000-ton mill, and additional supply can be developed.

The new concentrator is being built in units of 3,600 tons capacity each. el throughout. The first unit, now under construction, is 300x505′ e, and steel has been ordered for the second unit, the contract calling for ery of material September, 1906. The first unit will be in operation late 06, or early in 1907 and the second unit probably will be nearly a year in completion. The two units, with their outlying buildings and yards, cover about 20 acres, and it is planned eventually to add 2 other units, g 12,000 tons daily capacity, which will exceed, by 2,000 tons, the full city of the reduction works of either the Anaconda or Calumet & Hecla, resent the two largest mills possessed by any mines.

The machinery plant for the new concentrator is to be of 3,000 h. p. capac-

The new plant includes a 50x105′ machine shop, with steel frame and c walls. The new concentrator will be served by an 8-mile branch of the Grande railway.

The nature of the ore, which is very evenly disseminated chalcopyrite, ssitates fine crushing, causing considerable sliming. The new mill is ex-ed to recover 25 to 30 pounds fine copper per ton of ore treated, putting o 23 tons into 1, giving concentrates averaging 26% to 30% copper, with o $10 combined gold and silver values per ton. Tailings of the old mill y 0.5% to 0.75% copper, which is too much, and doubtless will be reduced.

At no point on the globe are there developments of greater importance, that are likely to have a more profound and far-reaching effect upon future of the copper industry. It is not beyond the bounds of possibility t the Utah Copper Co. is the pioneer in solving the question of the world's ure copper supply—a question that has been given much serious consider-on during the past few years, by the largest consumers of the metal. e mining work of the Utah Copper Co. is an evolution, yet it may prove be the beginning of a revolution also.

Heretofore the world's supply of copper has come from native copper and m nature's concentrated deposits of copper ore. The Utah people have ne to the original repository of the metals—the rock magma from
nning processes of leaching, precipitation and concentration, Da
s brought the disseminated chalcopyrite up to deposits of work
e porphyry worked by this company undoubtedly
nsiderable extent, since expelled from a vent in t
t the mine must be regarded as a step in advance
mplished in mining. The mine of the Utah Co
ein, lense or stockwerk, but upon the original m

our mineral values. The Utah has gone down to the backbone of nature, for its ores, and the success of the company, which is not open to question, opens a new and vast field of possibilities in the mining world.

The Utah Copper Co. has, so far as known, the largest ore body of any metal ever opened, at any time, in any part of the world. Its ore body, so far as proven by openings and the drill, contains fully 250,000,000 tons of ore, carrying approximately five millions tons of fine copper, one hundred and twenty-five million ounces of silver and seven million five hundred thousand ounces of gold, metals worth, at 15 cents per pound for copper and 60 cents per ounce for silver, about seventy-five millions of dollars for the silver, one hundred and fifty millions of dollars for the gold, and fifteen hundred millions of dollars for the copper, which should be produced at an ultimate profit of one hundred and fifty millions to two hundred and fifty millions of dollars.

At the end of 1905 the old mill was treating about 650 tons of ore daily, planned to be increased, a little later, to an average of 1,000 tons daily. The old mill is said to have shown earnings as high as $1.50 per ton, which should be greater, with the new plant running, at the same price for copper. With the new mill in operation, the company should be able to mine by steam-shovel, at 30 cents per ton, with a freight rate of 30 cents to Garfield, an estimated average cost of 75 cents per ton for milling, and 15 cents for smelting charges in reverberatories, and miscellaneous charges of 25 cents to 35 cents per ton, giving a total cost of $1.75 to $1.85 per ton of raw ore treated.

There seems some basis for the complaint of Col. Wall, who is persona non grata with the management, that the ore is slimed extensively, and too large a proportion of the values lost, but the ore is of such a nature that considerable sliming seems unavoidable. Col. Wall is mistaken, however, in condemning the use of the steam-shovel.

Production, 1904, was 3,898,490 lbs. fine copper, and for 1905 was 5,473,469 lbs. fine copper, and for 1906 should be between 6,000,000 and 7,000,000 lbs. fine copper. With two units of the plant completed, and the old 1,000-ton mill in operation, the property should have a productive capacity of circa 65,000,000 lbs. fine copper yearly, after the completion of the second unit of the new mill. The property, beyond question, is one of the future great copper mines of the globe.

UTAH DEVELOPMENT CO. **UTAH.**

Office: Salt Lake City, Utah. Letter returned unclaimed from former mine office, Bingham Canyon, Salt Lake Co., Utah. Organized 1905, with capitalization $3,000,000, shares $5 par, as successor of New Red Wing Mining Co., giving 1 share of Utah Development for 3 shares of New Red Wing. Company is said also to have secured control of the Butler-Liberal Consolidated Mining Co. The Red Wing mine has a 5′ vein carrying a 3′ paystreak assaying up to 23.2% copper, 12% lead, 60 oz. silver and 0.04 oz. gold per ton, opened by 3 tunnels, No. 3 tunnel, of circa 700′ length, being claimed to show a 50′ vein of milling ore, carrying values mainly in lead and silver.

I & EASTERN COPPER CO. **UTAH.**

Offices: 127 Church St., New Haven, Conn. and Salt Lake City, Utah. office: Dixie, Washington Co., Utah. Works office Shem, Washington Utah. Louis E. Stoddard, president; Chas. E. Graham, vice-president; . Farnam, secretary and treasurer; Chas. H. Doolittle, general manager nised February, 1901, under laws of West Virginia, with capitalization 0,000, shares $5 par.

Lands, 11 patented claims, area 220 acres, also a 40-acre smelter-site, g lands including the old Dixie mine, in the Tutsagubet or Cave Springs ict, near Green river. Property shows 5 fissure veins, in limestone, ave. f estimated average width, carrying cuprite, azurite and massive mala-, giving average assays of 15% copper. Principal development was 775' blind shaft, sunk from the breast of a 225' tunnel, but the shaft d, June 1, 1905, and it was necessary to run a new tunnel of 900', to n the mine. Old workings were said to show about 100,000 tons of The mine uses gasoline power.

The old 25-ton smelter, poorly located, is idle. The new smelter, at a, has a 100-ton water-jacket blast-furnace. Power for blower is secured i the Santa Clara river, circa 2 miles distant, and an auxiliary steam t is being added, to provide against shortage in water-power. The pany has built a 50-mile road, with a down-grade haul between the lter and Acoma, on the Rio Grande Western, the nearest railroad point. will use a traction engine for transport.

Owing to the trouble at the mine, production for 1905 was only 460,166 fine copper, as against 1,448,597 lbs. in 1904, but the 1906 production ld be much larger. The property is hampered by lack of rail connections. is undoubtedly valuable, and has a good management.

AH-NEVADA COPPER CO. **UTAH.**

Office: 801 Equitable Bldg., Denver, Colo. Mine office: Elgin, Grand , Utah. John P. Brockway, president; Dr. W. F. Temple, vice-president. n. M. Ingersoll, secretary and treasurer; E. P. Wolverton, general manager; ceding officers and N. T. Plummer, directors. Organized January 9, 05, under laws of Arizona, with capitalization $1,250,000, shares $1 par. ernational Trust Co., Denver, registrar.

Lands, 45 claims, area 900 acres, also seven 5-acre mill-sites, in the Keg rings district of Emery county, Utah, and 1,220 acres of hydro-carbon posits, in the eastern end of Wayne county, Utah, giving total holdings 2,215 acres. The Keg Springs lands show sundry fissure veins and con-ct veins between limestone and porphyry, carrying melaconite and chal-cite, assaying up to 70% copper, 30 oz. to 50 oz. silver and $5 to $15 r ton. Development is exclusively by open-cuts, company esti- at 200,000 tons of second-grade ore, worth $50 to $70 per ton, is ereby, which seems excessive. Mill tests of second-grade ntration of 6 into 1, ore treated assaying 18.8% c oz. gold, which would give concentrates of the 12.8% copper, in addition to gold and silver value

portion of the copper were lost, which probably was the case. Ores of such grade never require concentration. Transportation, as planned by the company, will be by barge and tug, on Green river, from a point about 7 miles below the mines, to the Rio Grande railway, giving a river haul of circa 50 miles.

Owing to serious dissensions, and complaints about the handling of the company's affairs, the management was taken away from Wm. F. Kendrick and associates, after work had been suspended for some time because the latter furnished no funds. The company planned beginning shipments circa May 1, 1906. Property is considered promising, but present management claims too much on the strength of very limited development.

UTAH-NEVADA GOLD & COPPER MINING CO. **UTAH.**

Office: care of David Jensen, vice-president, Ogden, Utah. J. Stanley Dee, president; W. D. Pyper, treasurer; I. C. Dallimore, secretary; Thos. Cunningham, superintendent. Organized 1903, with capitalization $500,000, shares $1 par. Lands, 6 claims, in the Newfoundland district of Box Elder and Weber counties, Utah, opened by sundry open-cuts, and by shafts of 50′ and 70′, showing 2 veins of 3′ to 5′ width, carrying chalcopyrite with pyrite and quartz gangue, assaying up to 32% copper, 17 oz. silver and $12 gold per ton.

UTAH QUEEN MINE. **UTAH.**

Letter returned unclaimed from former mine office, Bingham Canyon, Utah.

UTAH SMELTING CO. **UTAH.**

Office: care of Bela Kadish, general manager, Ogden, Utah. Mine office: Bonneville, Box Elder Co., Utah. David Eccles, president; Chas. Nibley, secretary; John Pingill, treasurer. Capitalization, $500,000. In May, 1906, company was excavating for the foundation of a sampling mill and 200-ton custom smelter, planned to be operated by electric power from the municipal plant at Brigham, 12 miles distant. Company is driving artesian wells, and the works are to have a spur-line of the Oregon Short Line railway, from Hot Springs.

UTAH SOUTHERN GOLD & COPPER MINING CO. **UTAH.**

Letter returned unclaimed from former office, 25 Broad St., New York. Felix Gottschalk, president; H. A. Crosby, secretary and treasurer. Organized April 10, 1903, under laws of Utah, with capitalization $500,000, shares $1 par; issued, $408,750. Lands, sundry claims, in the Beaver Lake district of Beaver county Utah.

UTICA MINING & MILLING CO. **COLORADO.**

Office: 1420 Chestnut St., Philadelphia, Pa. Mine office: Ward, Boulder Co., Colo. G. A. Davison, superintendent, at last accounts. Ores carry gold, silver and copper. Has water power and a 20-stamp mill.

VAL CASTRUCCIO MINES. **ITALY.**

Mine office: Massa Marittima, Grosseto, Italy.

VAL D'ELSA COPPER CO., LTD. **ITALY.**

Letter returned unclaimed from former office, Glasgow, Scotland.

DEZ, COPPER RIVER & YUKON RAILWAY CO. **ALASKA.**
A stock-jobbing proposition, put out by L. E. Pike & Co., of 294 Washn St., Boston, Mass., notorious promoters of swindling "mining" stocks.

)ORO VALENCIA. **PERÚ.**
Mine office: Quichin, Camaña, Perú. Is a small copper producer.

ENCIA COPPER MINING CO. **CALIFORNIA.**
Office: Hayward Bldg., San Francisco, Cal. Letter returned unclaimed former mine office, Sherwood, Trinity Co., Cal. Chas. E. Laumeister, ident; J. E. Manning, secretary and treasurer; F P. Burris, superintendent. nized under laws of Arizona, with capitalization $1,000,000, shares ar. Lands, 12 copper claims, area 248 acres, also 3 quartz-gold claims, 60 acres, and 240 acres of placer-gold claims, all well watered and timd, on the East Fork of New River, near the summit of the Trinity-Salmon e, with extensive water-rights, including two falls of 150′ each. The er claims carry a heavy gossan capping and are slightly developed by nnels. Idle for several years.

IADAD VALENCIANO-ANDALUZA DE ALTOS HORNOS y MINAS DE PEÑAFLOR. **SPAIN.**
Office: Glorieta, 1, Valencia, Spain. Mine office: Peñaflor, Sevilla, Spain. Baldomero Deu, president and agent. Capitalization 1,500,000 pesetas, es 250 pesetas par. Property is the Elvira mine and extensions, carrycopper and iron pyrites, at Peñaflor, and a group of claims, area hectareas, at Pueblo de los Infantes, Sevilla. The Peñaflor group was ler development, at last accounts.

LENTINE COPPER & GOLD MINING CO. **UTAH.**
Office: care of J. W. Cairns, president and manager, Salt Lake City, h. Letter returned unclaimed from former mine office, Bingham Can, Salt Lake Co., Utah. Organized 1904, with capitalization, $150,000. de several small shipments of high-grade ore to local smelters, in 1904, l is said to have a vein carrying a 2′ paystreak of excellent ore. Idle.

LENSUELLA COPPER CO. **ARIZONA.**
Office: 3543 W. 23d Ave., Denver, Colo. Mine office: Quartzite, Yuma , Ariz. Employs 25 men. Col. Richard Darling, president and general nager; F. W. Deidesheimer, treasurer; Geo. C. Foulkes, secretary. Organd November, 1901, under laws of Arizona, with capitalization $1,250,000. ares $1 par. Lands, 7 claims, patented, area circa 100 acres, also a 60-acre ill and smelter site, 12 miles southwest of Quartzite, 70 miles from the uthern Pacific railroad and 15 miles from a steamer landing on the Colorado ver, supplies being received by water. Country rocks are limestone and hist, carrying 2 contact veins, of fair size, developed by shafts of 200′ and 0′, with about a quarter mile of workings, showing malachite, azurite d oxide ores, giving average assays of 12% copper, 4 oz. silver and $4 gold r ton. Has gasoline power, with 2 hoists, good for depth of 500′ each, 2 ine-houses, a smithy of 18x24′ size, and 6 dwellings.

At last accounts, late in 1905, company was installing a 30-ton Vulcan

water-jacket blast-furnace, which it was planned to blow in, circa June, 1906. Water for the smelter has been secured by a 1,000′ artesian well.

VALEO MINING CO. **UTAH.**

Office: care of Hon. Thomas Kearns, general manager, Salt Lake City, Utah. Mine office: Park City, Summit Co., Utah. J. P. Boyle, superintendent. Ores carry gold, silver and copper. Has steam power and employed about 25 men, at last accounts.

VALERIE MINE. **YUKON.**

Mine office: White Horse, Yukon, Canada. Shipped 50 tons high-grade chalcopyrite, 1903, to the Crofton smelter. Requires a local smelter, or adequate transportation facilities, to become a regular producer.

MINA VALLENARINA. **CHILE.**

Office and mine: Taltal, Antofagasta, Chile. Pedro Herrera, owner and manager. Employed circa 25 men, at last accounts.

VALLEY MINING CO. **COLORADO.**

Office: care of Chas. S. Magowan, president, Iowa City, Ia. Mine office: West Cliff, Custer Co., Colo. John I. Christie, secretary; Sam. E. Palmer, general manager; Harry Triplett, mine superintendent: Frank L. Card, mill superintendent. Organized under laws of Colorado, with capitalization $150,000, shares $1 par. Lands, 6 patented claims, area 72 acres, also a 20-acre millsite, in the Silver Cliff district, with 6 veins of 2″ to 2′ width, opened by shafts of 175′ and 280′, with 1,300′ of workings, showing ore giving average assays of 2.5% copper, 17% lead, 1% zinc, 10 oz. to 13 oz. silver and $4 gold per ton, from oxidized ores, with occasional native copper. Has a 75-h. p. steam plant at mine, with 2 hoists and an air-compressor, and a 60-ton concentrator, 50x175′, of brick and wood, having a 150-h. p. steam plant, 18″ Blake crusher, 2 trains of rolls, 6 Card concentrating tables, 2 sizers and 500′ of canvas slime-tables.

VALLEY VIEW MINING CO. **CALIFORNIA.**

Office: San Francisco, Cal. Mine office: Lincoln, Placer Co., Cal. Lands, 90 acres, patented, showing impregnations 250′ wide, with circa 25′ of ore, between schistose walls. Has a gossan outcrop, nearly 110′ wide and 1,000′ long, carrying average gold and silver values of about $4 per ton. Ore shipped averages about 5% copper. Has two 5′ Huntington mills.

VALLEY VIEW MINING CO. **MONTANA.**

Letter returned unclaimed from former mine office, Anaconda, Mont.

VALRUBIO GROUP. **SPAIN.**

Offices: care of M. Yglesias, owner, 2 Tokenhouse Bldgs., London, E. C., Eng. Mine office: Paimogo, Huelva, Spain. Property includes the Valrubio, San Carlos and San Andres mines, with total area of circa 200 acres, lying between the Romanera and Monterubio groups, and carrying the western extensions of the San Vicente veins.

VAL VERDE COPPER CO., LTD. **ARIZONA.**

Insolvent. Fully described in Vol IV.

VAN ANDA COPPER & GOLD MINES CO., LTD. **BRITISH COLUMBIA.**

Dead.

ANDA MINES & SMELTER. **BRITISH COLUMBIA.**
Dead. Property was the Cornell and Copper Queen mines.

COUVER & BOUNDARY CREEK DEVELOPMENT & MINING CO. **BRITISH COLUMBIA.**
Mine office: Penticton, Yale district, B. C. C. Vasher, manager. Ores r gold, silver and copper Has steam power. Idle.

COUVER ISLAND MINING & DEVELOPMENT CO., LTD. **BRITISH COLUMBIA.**
Offices: 45, Leadenhall St., London, E. C., Eng. Mine office: Duncans couver Island, B. C. F. H. Faviell, chairman; Clemont Livingston, al manager; J. I. Fifield, secretary. Organized November 18, 1902. capitalization £50,000, shares £1 par; issued, £27,420. Is said to plan an ase of capitalization.
Lands, circa 1,800 acres, east of the Esquimalt & Nanaimo railway, ly lying east of the Tyee and supposedly carrying the eastern extension e Tyee copper formation. Principal development is on the Westholm n, having a 510′ two-compartment working shaft, with about ½ mile penings, showing some ore of 3% to 10% copper tenor, drifts on the level showing a wide mineralized zone, with occasional concentrations opper, but no ore body of commercial size has been discovered as yet. Westholm shaft is 700′ west of known occurrence of ore at the Tyee. agement is excellent, and property is considered well located.

PAÑIA FERROVARRIA VASCO-CASTELLANA. **SPAIN.**
Office: Madrid, Spain. Mine office: Burgos, Burgos, Spain. Property is Mina de Peneda, undergoing development at last accounts.

LED PROPHET COPPER CO., LTD. **ARIZONA.**
Office: 27 William St., New York. Mine office: Clifton Graham Co. t. Ben M. Crawford, general manager. Capitalization $500,000, shares par. Lands, 5 claims, area 100 acres, near the Shannon, Standard and r England & Clifton mines, developed by open-cuts and short tunnels, wing high-grade surface ores, giving assays of 16% to 20% copper, and centrating ores giving assays of 4% to 8% copper, with an average of ut 6 oz. silver and $4 gold per ton. Idle.

LARDEÑA MINING & SMELTING CO. **MEXICO.**
Office: 71 Broadway, New York. Mine and works office: Velardeña, rango, Mexico. D. M. Haynes, superintendent; M Dahlgren, mine superendent; Wm. Daly, smelter superintendent. Is controlled, through ownhip of 60% of capital stock, by American Smelters Securities Co.
Lands, 2,500 pertenencias, area 6,177 acres, including a number of mines, which the Terneres and Santa Maria silver-lead mines and the Copper een mine, carrying argentiferous copper ores, are the more developed, and the principal producers. The mines are said to have upwards of 800,000 s of ore blocked out, including considerable lead ore, the mines carrying ch lead, though opened originally for copper. The reduction plant is at ardeña, on the line of the Mexican International railway, 24 miles from mines, and connected therewith by the Ferrocaril Velardeña. The

200-ton concentrator is to be increased to 500 tons daily capacity. The old smelter is idle, having been replaced by a new smelter of 1,000 tons daily capacity, which it was planned to blow in circa July, 1906. It is planned to double the capacity of this smelter, to 2,000 tons, rendering it the largest custom smelter in Mexico. The plant is well arranged, handling of material being automatic throughout, as far as possible, the works having been designed to handle low grade copper and lead ores, with a maximum of economy. An ore-bedding plant is to be installed, permitting systematic mixing of ores before charging. A 1,200-h. p. central steam plant is planned, to generate electricity for the mines and smelter. The property is considered promising, and is under an experienced and fully capable management.

VELVET-PORTLAND MINE, LTD. **BRITISH COLUMBIA.**

Reorganized, Nov. 18, 1905, as New Velvet Portland Mine, Ltd.

VELVET (ROSSLAND) MINE, LTD. **BRITISH COLUMBIA.**

Merged, January, 1904, in Velvet-Portland Mine, Ltd.

VENICE COPPER CO. **MEXICO.**

Office: Venice, Ill. Letter returned unclaimed from former mine office, Soyopa, Sonora, Mexico. Lands supposedly sold to Calumet & Yaqui River Copper Co.

VENTURA COLORADO COPPER MINING & SMELTING CO.

Incorporated, 1903, under laws of Colorado, by D. H. De Arman, et al.

VENTURE HILL MINING CO. **ARIZONA.**

Office and mines: Jerome, Yavapai Co., Ariz. Thos. E. Campbell, president and general manager; Geo. H. Avery, vice-president and superintendent; Chas. F. Avery, secretary; Frank E. Jordan, treasurer. Organized 1900, under laws of Arizona, with capitalization $3,000,000, shares $1 par. Lands, 6 patented claims, area 110 acres, in the Verde district, showing 2 fissure veins, claimed by company to average 90′ width and to carry average values of 4.7% copper, 6.5 oz. silver and $4 gold per ton, in oxide and sulphide ores, developed by shafts of 65′ and 87′, and tunnels of 205′ and 457′. Presumably idle.

VERDE APEX COPPER CO. **WYOMING.**

Supposed to have had copper claims somewhere in Wyoming

VERDE APEX COPPER MINING CO. **ARIZONA.**

Office: care of Chas. B. Lutz, president Bloomsburg, Pa. Mine office: Jerome, Yavapai Co., Ariz. F. E. Jordan, agent. Organized 1900, with capitalization $3,000,000, shares $1 par. Lands 6 claims, area circa 90 acres, in Mescal Gulch, about one mile south of Jerome, slightly opened by shaft and tunnel. Out of funds and may lose lands.

VERDE CHIEF COPPER MINING CO. **ARIZONA.**

Office: 20 Broad St., New York. Mine office: Jerome. Yavapai Co. Ariz. Chas. L. Tompkins, president; Dr. W. E. Delabarre, vice-president; Frank K. Kohler, secretary and treasurer; R. H. Smith, assistant secretary and treasurer. Organized June, 29, 1900, under laws of Arizona, with capitalization $3,000,000, shares $1 par. Annual meeting, first Monday in July.

Lands, 13 claims, 3 patented, area 300 acres, in the Verde district, 7 les south of Jerome, including the Carrigan & Gaskette group, in Mescal ich, adjoining the Cleopatra, and 3 patented claims, known as the Paragon up, purchased recently. The Carrigan & Gaskette group has given 1,700′ of rkings, showing auriferous and argentiferous sulphides. Work is to be ncentrated on the Paragon group, which has tunnels of 135′, 150′ and 160′ length, the 150′ tunnel showing ore. New management plans testg property thoroughly by diamond drill before resumption of mining.

ERDE CONSOLIDATED COPPER CO. **ARIZONA.**

Office: Prescott, Ariz. Mine office: Jerome, Yavapai Co., Ariz. Jacob arks, president; T. E. Campbell, secretary and treasurer. Capitalization 500,000, shares $1 par. Idle.

ERDE GRANDE COPPER CO. **MEXICO.**

Office: 308 North 6th St., Louis, Mo. Mine office: Aparado 96, Hermoso, Sonora, Mexico. C. P. West, president; R. L. Wood, treasurer; Thomas yson, secretary; Jairus D. Fresh, general manager; Jas. Penman, superintendent. Organized 1901, under laws of Arizona, with capitalization 2,500,000, shares $5 par. Lands, 500 acres, in the Cora district, circa 40 miles orthwest of Hermosillo, partly timbered with ironwood, catclaw and esquite. Main tract of 460 acres includes La Verde, La Verde Grande, a Cobriza and San Luis groups, claimed to show veins of 10′ to 100′ width, largest veins being lowest in grade. The Verde Grande group shows deposits n limestone, near eruptive rocks, giving ores assaying 6% copper, 6 oz. ilver and $1 gold per ton. La Verde and La Cobriza groups show a contact ein, between granite and quartzite, claimed to be of 30′ to 60′ width and raceable 7,000′, carrying argentiferous and auriferous ores assaying 5 3/4% to 16% copper, with gangue of talcose limestone, interstratified with granite and quartz. Mine is developed by 6 different shafts and tunnels, with nearly one mile of workings, claimed to show 300,000 tons of ore.

The smelter, 1½ miles from the principal mine openings, has a 100-ton Allis-Chalmers water-jacket blast-furnace, completed 1904, but idle, company claiming that coke was too expensive, hence the management has installed a 30-ton Medbury furnace, and claims to have ordered 2 more of the same size. This furnace burns charcoal, made from ironwood and mesquite, claimed to cost $16, Mexican, per ton. Management reported, April 24, 1906, that "on account of the exceeding hardness of the charcoal, and in order to reduce the speed necessary of the pulverizer, they would add additional machinery which would considerably reduce the power at present required to run the machinery, and thereby lessen the expense of refining the ore." This explanation is so luminously self-explanatory that only the exceedingly dense will find it difficult to form an opinion as to exactly what is the trouble with this company, and its management. A leaching plant was being installed, 1904, but nothing has been heard of the same recently.

The company is supposed to be considerably in debt, to sundry large shareholders, who advanced funds to keep the property going. The s

tising of this company has been utterly untruthful, and the methods of operation seem to have been vacillating and inefficient.

VERDE KING COPPER CO. **ARIZONA.**

Office: 401 Henne Bldg., Los Angeles, Cal. Letter returned unclaimed from former mine office, Jerome, Yavapai Co., Ariz. Chas. J. George, president; Baron W. Riley, secretary; Joseph Gray, superintendent. Organized 1900, under laws of Arizona, with capitalization $1,000,000, shares $1 par. Lands, 20 patented claims, adjoining the Cleopatra, said to have circa 3,000′ of workings, including a 200′ two-compartment shaft. A crosscut from a long tunnel exposed 16′ of low-grade ore, carrying copper, silver and gold values, but the tunnel was abandoned. Lands are considered well located, but the repeated excuses of the management, for the idleness of the property, are regarded as decidedly thin.

VERDE MINE. **CALIFORNIA.**

Letter returned unclaimed from former mine office, Redding, Shasta Co., Cal. Is a group of 12 idle claims, adjoining the Shasta King group of the Trinity Copper Co., opened by a 600′ crosscut tunnel, showing a small vein of good copper ore.

VERDE MINING & MILLING CO. **WYOMING.**

Office: 523 Bee Bldg., Omaha, Neb. Letter returned unclaimed from former mine office, Battle, Carbon Co., Wyo. C. M. Jacques, president; J. E. Thacher, secretary and treasurer; G. F. Hinton, general manager; preceding officers, G. H. Lyons and A. H. Crow, directors. Lands, 4 claims, area 80 acres, showing a 35′ fissure vein, carrying malachite, bornite and chalcopyrite, giving assays of 5% to 21% copper, 6 oz. silver and $5 gold per ton, opened by shafts of 40′ and 115′. Has a 40-h. p. steam plant. Idle for several years.

VERDE QUEEN COPPER CO. OF ARIZONA. **ARIZONA.**

Letters returned unclaimed from all former offices. Lands were 28 claims, with a 40-ton smelter, near Jerome, Yavapai county, Arizona. Lands were not sold to the United Verde, in 1904, as was asserted.

VERDI MINE. **MONTANA.**

Mine office: Hamilton, Ravalli Co., Mont. J. C. Carter, superintendent. Lands, 5 claims, said to show ore assaying 26% copper, with a trace of gold.

FRANCISCO VERGARA I. **CHILE.**

Office and mine: Petorca, Aconcagua, Chile. Owns and operates the Mauro mine, opened 1860, making matte equivalent to about 225,000 lbs. fine copper yearly.

VERMONT & ARIZONA COPPER CO. **ARIZONA.**

Office: 150 College St., Burlington, Vt. Mine office: Tombstone, Cochise Co., Ariz. Hon. Hamilton S. Peck, president; J. H. McLoud, secretary and treasurer; J. A. Collier, superintendent. Organized 1899, under laws of Arizona, with capitalization $1,500,000, shares $5 par. Lands, 11 claims, area 230 acres, 4 miles from from Gleeson, on the western slope of the Dragoon Mountains, in the Turquoise district, showing 2 gold and silver veins and several copper veins, latter giving assays of 23% to 43% from selected carbonate

ores, opened by a 230′ main shaft, with 1,500′ of underground workings, and also having about 1,000′ of development on 10 adjoining claims. Has steam power and is developing in a small way.

VERMONT & BOSTON MINING CO. **VERMONT.**

Presumably dead. Letters returned unclaimed from former office and former mine office.

VERONICA COPPER MINING CO. **MONTANA.**

Mine office: Butte, Silver Bow Co., Mont. Organized Apr. 27, 1906, under laws of Montana, with capitalization $150,000, shares $2.50 par.

AKTIESELSKABET VESTERDALENS KOBBERGRUBER. **NORWAY.**

Office: Melderstein, Sweden. Mine office: Næverfjord, Norway. Henning Nordlund, chairman; August Siljeström, superintendent. Organized 1903, under laws of Norway. Employed circa 60 men, at last accounts.

VETA GRANDE MINING CO. **MEXICO.**

Mine office: Bacoachi, Arizpe, Sonora, Mexico. Employs 50 men. James Finch, president; James Hooper, superintendent. Capitalization, $1,000,000. Lands, sundry claims, 10 miles south of Bacoachi, opened by a tunnel and a 250′ three-compartment shaft, showing a 56′ vein, carrying auriferous and argentiferous copper ores, assaying $40 to $9,000 per ton, with values mainly in silver. Is developing vigorously, and is considered promising.

VETA RICA SILVER & COPPER MINING CO. **MEXICO.**

Mine office: Charcas, San Luis Potosí, Mex. C. H. Hoffman, manager. Has steam power. Presumably idle.

VETERAN-ELY COPPER CO. **NEVADA.**

Mine office: Ely, White Pine Co., Nev. Is controlled by practically the same management and owners as the Cumberland-Ely. Organized, circa January, 1906, under laws of Maine. Lands, 15 claims, adjoining the Giroux Consolidated.

VICKERY-THOMPSON MINING CO. **MEXICO.**

Office and mine: Ocotlán, Oaxaca, Mexico. Guillermo W. Thompson, manager. Lands include properties in the Ocotlán, Tlacolula, Villa Alta and Ixtlán districts of Oaxaca. Apparently has some connection with Compañía Minera Zapoteca. The interest of Frank A. Vickery in this company is said to have been sold, 1905, to G. W. Thompson.

VICTOR BONANZA MINING CO. **CALIFORNIA.**

Office: care of M. T. Dooling, president, Hollister, Cal. Letter returned unclaimed from former mine office, Dos Palos, Merced Co., Cal.

VICTOR CONSOLIDATED MINING CO. **UTAH.**

Mine office: Eureka, Juab Co., Utah. Vivian McCune, general manager; J. Treloar, superintendent. Lands include the Victor, Boss Tweed and other mines, carrying gold, silver and copper ores. Has steam power.

GEWERKSCHAFT VICTORIA BLEIERZ- UND ZINKBLENDE GRUBEN. **GERMANY.**

Office: Köln, Germany. Mine office: Nassau a/L., Rheinprovinz, Germany. Lands, 370 hectares, carrying silver, lead, zinc and copper ores.

VICTORIA BOULDER MINING CO. **COLORADO.**

Mine office: Salina, Boulder Co., Colo. M. B. McClure, manager, at last accounts. Ores carry gold, silver and copper. Has steam power.

VICTORIA COPPER CO. **AUSTRALIA.**

Reorganized repeatedly. Now the African & Australian Co., Ltd.

VICTORIA COPPER MINING CO. **MICHIGAN.**

Office: 539-53 State St., Boston, Mass. Mine office: Victoria, Ontonagon Co., Mich. Employs 100 men. Fred H. Williams, president; Chas. D. Hanchette, vice-president; James P. Graves, secretary and treasurer; preceding officers, Wm. F. Humphrey and Calvin Austin, directors; Geo. Hooper, superintendent; Con. Bedell, mill superintendent; C. R. Forbes, engineer; Henry N. Greely, auditor; C. R. Everett, clerk. Organized Jan. 16, 1899, under laws of Michigan, with capitalization $2,500,000, shares $25 par; paid in, $12. Last assessment, $1, August, 1905. Statement, as of date January 1, 1906, gave assets, exclusive of mine and equipment, of $73,692, with liabilities, being a balance due former shareholders, of only $639.33. First National Bank, Boston, registrar. Shares are listed on the Boston Stock Exchange. Annual meeting, fourth Monday in February.

Lands, 2,289 acres, in Sections 19, 20, 29, 30 and 31, Town 50 North, Range 39 West, and Sections 24, 25 and 36, T. 50 N., R. 40 W., in Ontonagon county, Michigan, giving a tract with an extreme width of two miles east and west, and an extreme length, north and south, of 2¾ miles, lying just west of the Ontonagon river, practically all on the mineral belt, only about 100 acres lying on the Eastern Sandstone. Neighboring mines, all idle for many years, are the West Minnesota on the north, National on the east and Devon on the west. Nearest active property is the Michigan, three miles northeast. Litigation over a 40% undivided interest in 320 acres of land, in the main mine tract, was settled, favorably to the company, September, 1905.

The first attempt at Lake Superior copper mining, in historic times, was made on the Victoria property, in the winter of 1770-1771. The next mining done was in 1849, when the property was opened, under the name of Cushin, on a line of prehistoric pits containing masses of native copper, one weighing upwards of a ton. Name was changed, 1850, to Forest mine, and property was reorganized, 1858, as the Victoria Mining Co. Under these titles the property made 186 tons, 1,279 lbs. fine copper, at a loss of about $180,000. The first stamp-mill was burned by a forest fire, and the second was swept away by a flood. The property was operated regularly, on a small scale, 1849-1855, and thereafter spasmodically. The mine was unwatered in 1881, but remained idle until 1899.

The mine is located on a high and steep hill, notwithstanding which the solid rock is covered with heavy sand and clay drift. The Forest amygdaloid lode, on which the mine is developed, is 5′ to 30′ wide, where opened, very irregular in width, rolling in dip and bunchy in contents, with a strike of circa N. 69° E., and average dip of 61° to the northwest, the strike giving about 1½ miles of outcrop on Victoria lands. The Forest bed evidently is one of the cupriferous amygdaloids of the Evergreen belt, opened to the

east by the Mass and Adventure, but which one of the series is uncertain. Work was begun March 1, 1899 under great disadvantages. The old mine four shafts, numbered from east to west, opened erratically, with shafts levels at various intervals, lifts being opened at distances of 55′ to 65′. No. 2, chosen for the main working shaft, was cut down to two-compart- size, 8x12′ inside measurement, and in cutting this shaft down from the to the third level, considerable barrel work and good stamp-rock was found at was the footwall of the old mine. No. 2 is 2,089′ deep, with levels be- he fourth opened at intervals of 100′. The formation is much disturbed the surface and the lode is irregular in dip, but with the widening noted pth, better defined walls are found also, as well as a considerable increase in er, showing some good stoping ground from the seventh level downward, near the bottom, where the lode widens to about 80′, with only occasional hes of copper. Nineteen levels have been opened and the mine has 3′ of underground openings.

Old No. 1 shaft, 240′ east of No. 2, is 188′ deep; old No. 3, 1,190′ west of 2, is 350′ deep and No. 4 is 180′ deep. In addition to productive openings, he Forest lode, the mine has about 3,000′ of crosscuts, showing sundry iferous beds, but none of promise equal to the Forest. The footwall scuts show an amygdaloid underlying the Forest at an average depth of 6′, this bed being well mineralized for 4′ to 5′ along the footwall, pro- ng small masses up to 50 lbs. weight, the copper occurring mainly on the , with considerable epidote on the hanging wall. Underlying this epidotal at a distance of circa 60′, is a 6′ amygdaloid, showing much epidote and d minerals, and a little stamp rock. An amygdaloid called the Glenn was ed in 1900, giving a fair showing of copper at the bottom of a shallow t. Diamond drill borings north of the mine have shown nothing of ial promise.

The Forest amygdaloid is low in grade, but quite regular in contents, ring a little heavy copper, but with values mainly in medium-grade stamp c. All levels down to the 18th are connected by winzes, giving ventilation safety. The ground stands well and the mine is without a stick of timber, ept in the shafts. Nearly 500,000 tons of stamp rock have been developed, l a considerable stock-pile has been accumulated on surface, from opening k. The copper chute at the Victoria rakes to the southwest, and the best und below the 15th level will be found in the southwestern drifts. Little ing work has been done since July, 1904, the management thinking enough ind opened for a mill, and devoting money and work to developing a er power and building a mill.

No. 2 has a frame rock-shafthouse 34x40′ on the ground and 90′ high, a 16x36′ wing. The power-house is 36x40′, with a 24x28′ wing, of wood, tone foundations, with steel roof. The hoist, of Webster, Camp & Lane e, is a duplex cylinder engine, with a single drum of 11′ face with 12′ imum and 8′ minimum diameter, set on a concrete foundation bedded on l rock. Equipment includes two 12-drill Rand air-compressors and 20 er drills. The old Nordberg hoist at No. 2, with 12x28″ cylinders and drum

of 5′ diameter and 6′ 9″ face, is available for use at No. 3 shaft. This hoist, rated at 1,200′ capacity only, was used in sinking No. 2 to its full depth of 2,089′.

Buildings at the mine include a 30x60′ machine-shop, of wood, with iron roof, a 24x72′ carpenter shop and warehouse, a two-story frame boarding-house and office, 27x64′, with 10x37′ ell, a 19x41′ frame schoolhouse, stone changing-house, general store and 58 dwellings. A 10x16x28′ storage cistern holds water from the mine for feeding boilers, and water for domestic uses and fire protection is pumped, by a steel windmill, from a well having a storage tank and 750′ of water mains. There is a sawmill, with 56″ circular saw, furnishing timber and lumber for the mine's requirements. Nearest railroad is the Chicago, Milwaukee & St. Paul, at Rockland, 3 miles distant. The company's lands are well timbered and contain an inexhaustible supply of good building stone.

A large water power has been developed from Glenn Falls, on the west branch of the Ontonagon river, about 1 mile from the mine, at a cost of $200,000. This is the best natural water power of the Lake Superior copper district, the stream dropping nearly 150′ in 1½ miles, by a series of small falls, between which are numerous rapids, with sandstone bottoms. Power is developed by means of a dam, canal and shaft. The dam, built up from excavations in bedrock, is 320′ between abutments, and has 32 eighteen-inch "I" beams, 10′ apart, sunk vertically 5′ to 10′ in bedrock, with cement filling. The dam has an extreme height of 24′, with width of 14′ at the bottom and 8′ at the top, and has a 320′ main section, with wings of 100′ and 160′, giving a total length of 580′, built with an arch up-stream, giving great strength. The dam is faced, on the water side, with 5x10′ plates of 3-16″ steel, bolted to the steel "I" beams through the concrete. The center of the dam has an apron 80′ wide, also a floating boom to guide logs, as the stream is used for logging operations, the dam being substantially built, so that it cannot be torn out by a log-jam. The outlet is a 44″ steel pipe, leading from the bottom of the dam to the power canal.

The canal diverting water from the dam is nearly 6,000′ in length, running for about 2,000′ through sandstone and 4,000′ through alluvium. The canal is 25′ wide at the top, 16′ wide at the bottom and 16′ deep. The outlet of the canal has 6 gates, in two sets, separated by a heavy concrete abutment. The gateways are made of 20″ "I" beams, set vertically 6′ apart, with 6 gates of heavy oak planking, worked vertically by rack and pinion, actuated by water power. The canal leads, from the foredam, to three vertical inlet shafts, 19′ from center to center, each 5′ in diameter and 334′ 6″ deep, lined with concrete. The shafts were sunk through solid sandstone, by means of 5″ holes bored to the required depth, after which the 5″ holes were enlarged to 5′ holes, by reaming with a special bit having 4 cutting arms, each 30″ in length, actuated by a No. 9 Rand drill.

Air is drawn into the shafts through five thousand tubes of three-eighths inch diameter, and is carried downward, as bubbles, by the falling water. At the bottom of the three shafts is a tunnel of 360′ length, leading to a large fan-shaped air-compression chamber, 26′ in height, 18′ wide at the entrance

e tunnel and 60′ wide at the extreme end, lined with boiler-plate. The isoned air, pulled down the shafts by suction and swept along the tunnel ıbbles by the rushing waters, is released, in the compression chamber, he constant accession of fresh air-bubbles, in myriads of millions, causes ression, the air being held from escaping backward by the superior ure of the falling water. The plant was designed for an air pressure of bs. per square inch, and when this pressure is exceeded, the air forces vater in the chamber below the mouth of a 12" vent-pipe, leading to ce. When, in operation, the pressure exceeds 123 lbs. per inch, which es speedily when the power is not used, the air rushes upward through ı hundred feet of pipe with tremendous force, carrying along with it, in ıge, some of the water which pulled it down, throwing a fine spray reds of feet in the air, with a roar that gives the listener some faint idea e terrific combat of the elements that continues ceaselessly, three hundred beneath, where man's cunning has harnessed together those warring ents of air and water, forcing each to coerce the other, and yield their tant energy to the pygmy who has entrapped them.

The outflow shaft, which would be called a tail-race if on surface, is sunk n angle of 80° and leads to the lower river. This novel hydraulic-matic power plant was completed in May, 1906, and worked exactly esigned, giving an available energy of 4,000 horse power, rendering it ı the most powerful single unit air-compressor in existence, and being ifth installation of its sort in the world. It is possible to operate one, or three of the inlet shafts, as may be desired, with corresponding ıtion of the energy developed.

The simplicity and economy of the Victoria power plant lie in its being lutely automatic. No machinery is required, the power being drawn off pipe, from the compression chamber. Not a pound of waste or a gallon l will be required for the operation of the plant. Its simplicity is per--turn a cock, and get the power, as easily as town-dwellers draw water ı a faucet. It seems as near an approach to perpetual motion as the ntieth Century is likely to evolve.

The mine and mill are connected by a 4,800′ tramline, in two sections, upper having a grade of 6% and the lower a grade of 12%. A stationary t at the top of the incline will serve as a starter, loaded cars bring back ties. A retarding engine might be made to develop power from the n-line, were it not that the Victoria already has all the power it can use, vered practically free, except for the interest on the cost of the installa-. The tram-line enters the mill over a 700′ trestle.

The mill, near the hydraulic works, is 50x150′ in size, of wood, with one 16" Cuyahoga stamp and 28 Hartz jigs. Foundations of mill and machin-are on concrete beds capping solid sandstone, machinery being anchored ye-bolts cemented into the rock. The stamp, and part of the washing hinery and shafting, were bought from the old mill of the Belt mine.

The Victoria has been managed with great prudence and economy, and, reason of its water power, has exceedingly cheap operating costs. The

mine is not rich, but it has the advantage of a skillful and economical management, and last, but not least, has absolutely the cheapest power possessed by any mine on the globe.

VICTORIA COPPER MINING CO. **UTAH.**

Mine office: Ashley, Unitah Co., Utah. Idle at last accounts.

VICTORIA GOLD & COPPER MINING CO., LTD. **BRITISH COLUMBIA.**

Office: English Point, B. C. Mine office: Rossland, Yale district, B. C. Frank E. Starkey, president and general manager; Albert G. Starkey, secretary and treasurer. Capitalization $1,000,000, shares $1 par. Lands, 200 acres, lying west of Rossland.

VICTORIA MINE. **ONTARIO.**

Owned by Mond Nickel Co., Ltd.

VICTOR MINING & SMELTING CO. **MEXICO.**

Office: Nogales, Ariz. Mine office: La Cananea, Arizpe, Sonora, Mexico. Louis J. Haas, president; W. H. Paul, vice-president; Frank P. Jackson, secretary and treasurer. Organized May, 9, 1905, under laws of Arizona, with capitalization $1,000,000, shares $10 par. Lands, sundry claims, circa 18 miles north of La Cananea, said to show copper ore.

FELIX VICUÑA. **CHILE.**

Office and mines: Barco, Higuera, Serena, Chile. Operates La Higuera mine, opened 1855, producing 800 to 1,000 tons of fine copper yearly. Also owns the Solitaria mine, 130′ deep, opened 1893, the Panchita mine, 350′ deep, opened 1850, and the San Ramón mine, 270′ deep, opened 1851, three last named mines being idle, at last accounts.

SANTIAGO VICUÑA. **CHILE.**

Office and mine: Huasco, Freirina, Atacama, Chile. Operates Los Astilleros mine, at Huasco, which made circa 500 metric tons of Chile bars yearly, at last accounts, and El Jirio mine, opened 1896, said to produce about 1,000 metric tons of bars yearly.

VIELLA COPPER CO., LTD. **SPAIN.**

Compulsorily wound up, February, 1903.

VIGSNES KOBBERVAERKS AKTIEBOLAG. **NORWAY.**

Office: Talbodgaden, 8B, Christiania, Norway. Mines include the Vigsnes and Stavanger, sometimes known as the Meraker mines, in the Röros district, south of Trondhjem, Norway. Deepest shaft is 2,389′. Were long the principal producers of Norway, and made 960 long tons fine copper in 1895, but since idle.

VILLAGE BELLE GOLD & COPPER CO. **COLORADO.**

Supposedly has lands in Routt county, Colorado.

VINCENNES-ARIZONA COPPER CO. **ARIZONA.**

Office: care of Gates M. Fowler, manager, Phoenix, Ariz. Letter returned unclaimed from alleged mine office, Kelvin, Pinal Co., Ariz. Had a working bond and lease on the Wood-Sower group, near Winkelman, which shows a heavy gossan capping, carrying occasional oxide and carbonate ores, with gold values of $2 to $5 per ton.

CATOR GOLD & COPPER MINING CO. **UTAH.**
etter returned unclaimed from former office, Ogden, Utah, and former office, Uintah, Weber Co., Utah. Geo. F. Busch, president; Sam T. , secretary. Capitalization $1,000,000, shares $1 par. Lands, sundry , slightly prospected, near Uintah.

A GOLD & COPPER MINING CO. **WASHINGTON.**
ffice: care of E. M. Kinnear, president, Spokane, Wash. Mine office: is, Okanogan Co., Wash. A. J. Squires, vice-president; T. W. Brown, ary and general manager; Arthur W. Lindsay, treasurer; preceding s and Joseph Coleman, directors. Lands, 7 claims, area 140 acres, in alena district, on the southern slope of Æneas Mountain, showing a z-porphyry dike, carrying ores giving good assay values in copper, silver and gold.

A VIRGINIA. **CHILE.**
fine office: Chañaral, Atacama, Chile. Manuel Hidalgo, owner; Fer- o Hernandez, manager. Employed circa 75 men, at last accounts.

GINIA BELLE GOLD & COPPER MINING CO. **ARIZONA.**
Dead. Lost lands, 1906, to Arizona Belle Mining Co.

GINIA CONSOLIDATED COPPER CO. **MARYLAND & VIRGINIA.**
Office: 618 Walnut St., McKeesport, Pa. Mine offices: Libertytown, erick Co., Md., and Stony Man, Page Co., Va. Employs 20 men. W. Harry ilton president; J. H. Lohman, vice-president; T. A. Robertson, secre- George B. Humick, treasurer; Thos. A. Dunshee, general manager; Cramer, mill superintendent. Organized October 15, 1901, under laws of Jersey with capitalization $1,000,000, shares $1 par; issued, $515,000. ls are in 2 groups, in Maryland and Virginia, with total holdings of 0 acres.

The Liberty mine, in Frederick county, Maryland, area apparently 850 s, held under a 20-year bond and lease, is an old property, long idle, ving 2 ore bodies, reported by company as deposits in limestone, apparently ed to depth of 90′, ore showing melaconite, malachite, chalcocite, nite and tetrahedrite, with values mainly in bornite, giving average assays .16% copper, 4.7 oz. silver and $1.80 gold per ton. Property is estimated management to show 50,000 tons of ore. Mine was closed down, 1860, account of the American Civil War and was reopened, 1876, for a short e only.

The Virginia tract, 220 acres, freehold, is on Hoak Mountain, showing 3 allel veins traversing trap and quartzite, one of which, opened by a 320′ ft, with 950′ of underground workings, is said to average 12′ wid e average assays of circa 6% copper, 4 oz. silver and $1.80 inly from carbonate ores, with occasional occur- uipment includes a gasoline hoist and a 3-dri

Equipment of the Liberty mine includes a 6 ist good for 1,000′ and a small Sullivan air-comp 16x28′ machine-shop, 20x28′ carpenter shop, 2 dwellings. The concentrator at the Maryland p

equipped with 3 Sturtevant centrifugal crushers, 3 Wilfley tables and a sizer, and is of 60 tons estimated daily capacity.

The company plans reopening the old Liberty mine which caved in, hence it will be necessary to sink a crosscut beneath the broken ground.

VIRGINIA COPPER CO., LTD. **VIRGINIA.**

Offices: 136 Liberty St., New York, and 95, Gresham St., London, E. C., Eng. Mine office: Highhill, Halifax Co., Va. Commodore P. Vedder, president; F. M. Davis, vice-president; Jas. B. Van Woert, secretary; Richard Lamb, general manager; Evan Davies, superintendent. Organized August 31, 1900, under laws of United Kingdom, with capitalization £300,000, shares £1 par. Lands, 1,617 acres, including the High Hill mine, in the Virgilina district, developed by 8 shafts of 140′ to 300′ depth, with about one mile of underground openings. Property shows 2 veins, giving assays up to 5.9% copper, 2 oz. silver and 80c. gold per ton, from highly silicious ores. Has a 350-h. p. steam plant and concentrator. Idle.

VIRGINIA COPPER MINING & SMELTING CO. **ARIZONA.**

Mine office: Casa Grande, Pinal Co., Ariz. W. P. Guthridge, superintendent. Property is the Reward mine, carrying argentiferous copper ore. Has steam power and a 30-ton water-jacket furnace. Presumably idle.

VIRGIN MINE. **ARIZONA.**

Office and mine: care of Wm. Baker, owner, Dewey, Yavapai Co., Ariz.

MINA LA VIUDA. **CHILE.**

Mine office: Caldera, Atacama, Chile. Said to be a considerable producer of copper.

VIVANDIERE CONSOLIDATED MINING & SMELTING CO. **COLORADO.**

Mine office: Turret, Chaffee Co., Colo. J. J. New, superintendent. Lands, 5 claims, opened by a 615′ shaft, showing ore of concentrating grade. Mine has a steam plant, with hoist and air-compressor, and a 50-ton mill, equipped with a crusher, Elspass mill and concentrating tables. Mine is said to have been leased, 1906, for 5 years, to a Leadville syndicate.

VOLCANIC COPPER MINING & SMELTING CO. **CALIFORNIA.**

Dead. Former office, 256 South Broadway, Los Angeles, Cal.

VOLCANIC MINE. **BRITISH COLUMBIA.**

Mine office: Grand Forks, Boundary District, B. C. Lands, 102 acres, on the north fork of the Kettle river, showing a vein claimed to be 600′ wide, carrying cupriferous pyrites, opened by an 800′ tunnel. Was under bond to the Volcanic Mining, Smelting & Development Co., but was not taken over, because the finances of the property were misrepresented. Property is considered promising, though low in grade, because of large size of its ore body.

VOLCANIC MINING, SMELTING & DEVELOPMENT CO. **BRITISH COLUMBIA.**

Out of business. Property not taken over, because misrepresented.

VON GERNET COPPER, LTD. **CHILE.**

Liquidated, October, 1905.

J. D. VORIS COPPER MINING CO. **COLORADO.**

Mine office: Hillside, Fremont Co., Colo. Presumably idle.

A VUELTA FALSA. **SPAIN.**

Office: care of Miguel Yglesias, owner, 2 Tokenhouse Bldgs., London, Eng. Mine office: Paimogo, Huelva, Spain. Group includes the Fyns and other mines, near the Chanza river, which separates Spain and Portugal. Property shows a vein of about 3' width, giving good assay values in copper, and circa 46% sulphur. Idle, except for a few men making cement from the mine waters.

CAN CONSOLIDATED COPPER CO. **NEVADA.**

Reorganized as, or succeeded by, Siegel Consolidated Mining Co.

CAN COPPER CO. **OREGON.**

Letter returned unclaimed from former office, San Francisco, Cal. Mine office: Takilma, Josephine Co., Ore. Bought the property of the Main View Copper Co., for $24,000. Mine is said to show a promising body of bornite. Equipment includes a 30-ton Vulcan smelter, never blown in.

CAN COPPER MINING CO. **WYOMING.**

Office: Wausau, Wis. Mine office: Encampment, Carbon Co., Wyo. M. Monroe, president; W. D. Kolloch, secretary; F. J. Lorcher, superintendent. Organized 1898, with capitalization $1,000,000, shares $1 par. Lands, acres, in the Encampment and Battle Lake districts. Has 3 shafts, past about 100', showing a 15' sulphide ore vein. Idle several years.

LCAN COPPER MINING & SMELTING CO. **NEVADA.**

Reorganized, 1901, as Vulcan Consolidated Copper Co.

LCAN MINING CO. **MICHIGAN.**

Wound up. Lands sold, 1905, to Keweenaw Copper Co.

ABASH MINING CO. **CALIFORNIA.**

Letter returned unclaimed from former office, Los Angeles, Cal. Mine ce: Letcher, Fresno Co., Cal. Dr. J. H. Bryant, president. Lands, claims, adjoining the Copper King, opened by 2 shallow shafts, d tunnels of 300' and 400'. Has a steam plant and air compressor. Idle.

ABASH MINING CO. **UTAH.**

Office: 521 Atlas Blk., Salt Lake City, Utah. Mine office: Park City, mmit Co., Utah. Employs 28 men. Nicholas Treweek, president and neral manager; James R. Barnes, vice-president; W. Mott Ferris, secretary d treasurer; preceding officers. John M. Dougherty and William Hatfield, rectors; D. M. Gillett, superintendent. Reorganized February, 1906, with pitalization $2,000,000, shares $5 par.

Lands, 320 acres, including 180 acres held under bonds aggregating 2,000, on which $11,000 was paid, November, 1905. Development is by 800' main shaft, and Sept. 1, 1905, the mine had 5,597' of workings. Prop- y shows 5 veins, of which 3 are considered promising, carrying mainly er and lead values, with a little copper and gold. Has a steam plant.

GNER-GREEN MINING & MILLING CO. **COLORADO.**

Letter returned unclaimed from former mine office, Pearl, Colo.

HNITA COPPER MINING CO. **MICHIGAN.**

Fraudulent. Name changed to Erie Cons. Mining & Reduction Co.

WAHSATCH MINING CO. **UTAH.**

Office: 2206 Lincoln Ave., Ogden, Utah. Mine office: Brigham City, Box Elder Co., Utah. H. C. Baker, president and general manager; J. W. Abbott, vice-president; H. C. Wadleigh, secretary. Organized April, 1904, under laws of Arizona, with capitalization $1,500,000, shares $5 par, stock issue being divided into 5% cummulative preferred and common shares. Lands, 505 acres, patented, on the western slope of the Wahsatch Mountains, 4 miles from Brigham City. Mine, as opened, carries mainly lead and silver values, but the company has copper deposits in a prospective stage. Equipment includes a 150-ton concentrator, connected with the mine by a 4,200′ aerial tram. Water is piped to the mine and mill under a considerable head, estimated to be capable of generating 180 h. p.

WAIDANI MINE. **JAPAN.**

Letter returned unclaimed from former mine office, Kamine-mura, Taka-gori, Bizen, Japan. Ore is argentiferous chalcopyrite, associated with sphalerite and galena, in two very thin veins. Was a small producer only, and presumably idle for several years.

WALDO SMELTING & REFINING CO. **OREGON.**

Office: P. O. Box 1487, Colorado Springs, Colo. Mine office: Takilma, Josephine Co., Ore. Chas. L. Tutt, president; K. R. Babbitt, vice-president; Spencer Penrose, secretary and treasurer; J. A. Hull, assistant secretary and treasurer; preceding officers, J. A. Hayes, J. O'B. Gunn and Col. T. Waln-Morgan Draper, directors: E. W. Walter, general manager. Organized December 3, 1901, under laws of Colorado, with capitalization $3,000,000, shares $100 par. Has the same management as the Takilma Smelting Co., with which it is very closely connected, the Waldo company having an interest in the Takilma smelter.

Lands, 20 patented claims, area 400 acres, with millsite, also 650 acres of placer lands, near the Queen of Bronze mine, in the Waldo district, showing 5 fissure veins, of about 10′ average width, giving estimated average values of 12% copper and $3 gold per ton, from sulphide ores, which probably is too high. Development is by a shaft and two tunnels, with extensive underground openings. The Copper King shaft, about 200′ deep, has an 80′ cross-cut-drift, showing a good ore body. The 700′ Lyttle tunnel and the 400′ No. 2 tunnel, on the same claim, show good ore bodies. The 310′ Cowboy tunnel connects with the incline shaft, 160′ below surface, and is to be extended to intersect known ore bodies. Property is about 40 miles from the Southern Pacific railroad, but a line has been surveyed through the district. The Takilma smelter was blown in, 1904, on Waldo ores. The Queen of Bronze mine of the Takilma company furnishes heavy sulphide ore, and the Cowboy mine of the Waldo provides oxidized ores, for furnace mixtures. Officers of the company are men of standing, with long and successful mining experience, and the property is considered promising.

GEWERKSCHAFT WALDSTOLLN. **GERMANY.**

Office: Düsseldorf, Germany. Mine office: Dernbach, Weimar, Ger-

many. Ores mined are spathic iron and a little chalcopyrite, 1902 production of latter having been 60 tons. Employs circa 35 men.

WALES COPPER MINING CO. **ALASKA.**

Merged, 1904, in Hadley Consolidated Copper Co.

WALLACE RIVER COPPER MINING CO.

Office: 89 State St., Boston, Mass.

WALLAROO & MOONTA MINING & SMELTING CO., LTD. **SOUTH AUSTRALIA.**

Offices: Grenfell St., Adelaide, South Australia. Mine offices: Wallaroo, Yorke Peninsula, and Moonta, Yorke Peninsula, South Australia. Works office: Port Wallaroo, Yorke Peninsula, South Australia. Employs circa 2,500 men. D. Davidson, secretary; H. Lipson Hancock, general manager. The Wallaroo mine, discovered 1860, and the Moonta mine, opened circa 1861, both on the Yorke Peninsula, about 10 miles apart, were amalgamated, 1890, under the present title. Has paid dividends, to end of 1905, of £224,000, and this company and its predecessors have paid dividends of £1,822,254, from a total mineral production valued at £12,245,554.

The Wallaroo mine, which includes the Kurilla, an adjoining property, is 6 miles east of Port Wallaroo, and employs 1,130 men, or nearly half of the total force, the balance being employed in the Moonta mines and at the reduction works. Area of the Wallaroo, including the Kurilla, is circa 2,000 acres, this property showing 6 practically parallel veins, the main ore body having a nearly vertical dip, with strike of North 75° West, ranging 3′ to 25′ in width and being opened for a length of 1,800′ and to a depth of about 2,500′. Country rock is metamorphosed mica-schist. The gossan gave a little atacamite and carbonate ores at surface, followed by cuprite and melaconite, but the oxidized bodies were worked out, many years ago. At depth the ore is mainly chalcopyrite, averaging 2% to 4% copper, as mined, and 11% after dressing. Gangue of the ore is iron pyrites, calcspar and schistose country rock, ores being slightly auriferous and argentiferous. The Wallaroo and Kurilla jointly have 30 shafts, with circa 35 miles of underground workings. Shafts are mainly inclines on the veins, hoisting with 2-ton and 3-ton skips, principal shafts being Taylor's shaft, 2,070′ deep, the Office shaft, 1,920′, and Young's shaft, 1,350′. The principal portion of Taylor's shaft was ruined by fire, early in 1904, and has been replaced by a new vertical shaft from surface, connecting with the lower levels of the old workings. The fire did much damage, destroying the pumping apparatus to a depth of 2,000′, but by heroic efforts pumps were installed, with compressed air power, since replaced by electric pumps. The Kurilla mine is opened on a lode parallel to the Wallaroo, to a depth of 1,170′, the ore body ranging 10′ to 12′ in width, but being bunchy, with high-grade chutes of ore averaging 11%, after hand-dressing. Ore in both the Wallaroo and Kurilla is won mainly by overhand stoping. Wide stopes are timbered by wooden pillars, with waste-filling on either side of the drifts.

The Moonta mine, 12 miles south of Port Wallaroo, was operated for years by a separate company, which was the first mining corporation in

Australia to pay £1,000,000 in dividends, though opened some ten years later than the rich gold mines of Bendigo and other Victorian fields. Area of the Moonta group is 2,673 acres, leasehold from the Crown. Country-rock is felsite-porphyry. The Moonta has 27 veins, ranging 6″ to 20′ in width, with 5 practically parallel main veins, having an average strike of N. 30° E., with numerous stringers and laterals. Development is by 21 trial shafts and 56 working shafts, many of the latter abandoned. Shafts are mostly vertical for a short distance, thence follow the dip of the lode, and the mine has upwards of 40 miles of underground workings. Mining is by both overhead and underhand stoping. Moonta ores are rich, and for years averaged 20%, but now average circa 16% copper, after dressing.

The mines have extensive hoisting, pumping and power plants. Having been opened at a period when mining practice was largely different from that of the present time, there are entirely too many shafts for economical working, and the policy of the present management is to reduce the number of shafts, and increase the capacity of those retained. Upon surface there were a great number of small, isolated machinery plants, and these, as far as possible, are being consolidated and replaced by large and modern plants. A new central power plant, at the Wallaroo branch, is effecting a very large saving in operating costs. Large and commodious changing houses, with shower-baths and lockers, have been built at the principal shafts, and the company maintains a library and reading-room, well supplied with books and periodicals.

The exceptional weight and flaky nature of the gangue renders concentration an exceedingly difficult problem. Large concentrators have been built at both groups of mines, and the process followed at each is essentially the same. The ore is dumped on grizzlies, passing to bins for various sizes, whence drawn off to railway trucks and carried to the concentrators. At the mills, after passing through crushers, with water, the material goes to revolving trommels, from which oversize goes to a traveling-belt, whence ore is picked by boys, and passed through crushers with water. Ores passing a ⅝″ mesh are treated on especially designed Hancock jigs, and raggings passing ⅞″ and 1¼″ meshes are treated separately on other specially designed Hancock jigs. Material rougher than 1¼″ is hand-picked from the traveling belt. The well known Hancock jig, now in use throughout the world, was especially designed by Mr. H. R. Hancock, the former general manager, for the use of these mines. The largest size jigs treat 200 tons of material in 8 hours. About 12% to 15% of the material is slimed, and this goes to spitzkasten, for classification and distribution to round tables and vanners, which turn out a product of 12% copper tenor.

The coarse material and tailings from the wash are piled in heaps, and weathered. These heaps range 20′ to 60′ in height, the tops of the coarser heaps being laid out in terraces. The heaps are systematically sprinkled, the leach-liquor, carrying 60 to 120 grains of copper to the gallon, running to vats. These heaps cover about 30 acres, and contain upwards of 1,000,000 tons of tailings.

The fine wastes and slimes go to a specially designed leaching plant. are passed through a series of vats containing leach-liquor 12 lbs. to s. of sulphuric acid being added to the leach-liquor for each ton of slimes ed. The slimes in the vats are agitated by revolving arms, the pulp. agitation, passing to settling dams and clarifying reservoirs. The liquor is drawn off, in earthen pipes, to the main precipitating works. e it joins the liquor from the various tailings heaps, and copper is precipitated therefrom on scrap iron. The material from the settling dams athered and given a second, and occasionally a third, leaching. The uction of cement copper from this plant is 15 to 20 long tons weekly. ddition to precipitate the leaching plant makes considerable limestone. The smelter, at Port Wallaroo, 6 miles from Wallaroo and 12 miles Moonta, is connected by rail with both groups of mines. In addition ating the company's ores, considerable custom smelting is done, the producing a blister copper of exceptional purity, the "Wallaroo" brand of l having a deservedly high commercial standing. An acid plant, utilizhe fumes of the smelter, furnishes H_2SO_4 for the leaching plants at the s, and in addition considerable commercial acid is sold. The average al output of the Wallaroo and Moonta is nearly 15,000,000 lbs. of fine er, but was only 13,070,952 lbs. in 1904, owing to the loss of production Taylor's shaft during the greater part of the year, and was 13,097 lbs., in 1905. The property is well handled, and many improvets are being introduced by the present highly progressive management.

LL STREET MINE. **NEVADA.**

Letter returned unclaimed from former mine office, Luning, Nev.

LTHAM MINE, LTD. **COLORADO.**

Offices: 155, Fenchurch St., London, E. C., Eng. Mine office: Russell h, Gilpin Co., Colo. Dr. J. H. Gower, managing director; E. T. Coote, etary. Organized June 16, 1903, with capitalization, £25,000, shares par. Lands include the Waltham mine, carrying gold, silver and copper . Idle for several years.

NDILTA COPPER MINES, LTD. **AUSTRALIA.**

Offices: 30, Moorgate St., London, E. C., Eng. Mine office: Kadina, ke Peninsula, South Australia. A. S. Caine, chairman; J. A. Russell, secre-. Lands, 140 acres, including the Wandilta mine, near Wallaroo. Main ft, 240'. Vein is 2' to 3' wide, with a limited amount of development. e idle and company apparently moribund.

PITI MINING CO. **COLORADO.**

Office: 932 Equitable Bldg., Denver, Colo. Mine office: Wapiti, Summit , Colo. A. J White, superintendent, at last accounts. Ores carry gold, er, lead and copper. Has steam and water power, concentrator and 5' ntington mill.

EDERICK WARDE GOLD & COPPER MINING CO. **NEVADA.**

Office: Salt Lake City, Utah. Frederick Warde, president; Jacob Myers, asurer; A. W. Raybould, secretary. Organized March 1, 1904, with a

zation $300,000, shares $1 par. Lands are in the Yellow Pine district of Lincoln county, Nevada. Company is said to have contracted to furnish ore to the Goodsprings Smelting & Development Co.

WAR EAGLE CONSOLIDATED MINING & DEVELOPMENT CO., LTD. **BRITISH COLUMBIA**

Office: 49 Wellington St. East, Toronto, Ont. Mine office: Rossland, Yale district, B. C. Geo. Gooderham, president; T. G. Blackstock, vice-president; preceding officers, W. G. Gooderham, A. E. Gooderham, Geo. T. Blackstock, W. H. Beatty, Chas. R. Hanswer and James Cronin, directors; E. B. Kirby, general manager; Carl R. Davis, superintendent; Chas. B. Jenkins, clerk and purchasing agent. Organized January, 1897, under laws of British Columbia, with capitalization $2,000,000, shares $1 par; issued, $1,750,000. Paid dividends of $544,250, June, 1898 to February, 1900, inclusive, since which date no dividends have been paid. Is controlled, through stock ownership, by the Consolidated Mining & Smelting Co. of Canada Ltd.

Lands include the War Eagle, Richmond, Crown Point and other claims, carrying auriferous and argentiferous copper ores. Like all other mines of the Rossland district, the War Eagle is much lower in grade at depth. Shipments, during 1905, were 60,860 tons, of $890,269.21 gross value, giving an average of $11.34 per ton, from which the company received, after deducting freight, smelting, refining and marketing charges, an average of $5.22 per ton. Production, at beginning of 1906, was circa 5,000 tons monthly, with ore reserves of 45,000 tons at end of 1905, compared with 23,000 tons one year previous. Production, 1905, is estimated at 1,400,000 lbs. fine copper.

WAR EAGLE MINE. **ALASKA.**

Mine office: Klawok, Alaska.. V. Nigelius, manager. Lands are on Big Harbor, 14 miles south of Klawok. In August, 1905, was developing, preparatory to beginning shipments to the Coppermount smelter.

WAR EAGLE MINE. **YUKON.**

A Yukon property, presumably located near White Horse, which made a small test shipment of bornite, to a British Columbia smelter, circa 1905.

WARRA WARRA MINE. **AUSTRALIA.**

Office: care of F. Stevens, Grenfell St., Adelaide, South Australia. Country rocks are clay-slates, sandstone and quartzite, in alternate strata. Has two shallow vertical shafts, opening fair-sized ore bodies carrying native copper, cuprite, malachite, chalcocite and chalcopyrite. Idle at last accounts.

WARREN DEVELOPMENT CO. **ARIZONA.**

Title changed, 1905, to Warren District Development Co.

WARREN DISTRICT DEVELOPMENT CO. **ARIZONA.**

Office: care of C. D. Hanchette, treasurer, Hancock, Mich. John Funkey, president; J. A. Fuller, secretary. Organized 1903, under laws of Michigan, with capitalization $100,000, shares $10 par; issued, $16,000. Lands, 12 claims, area 200 acres, adjoining the Higgins group, at Bisbee, Cochise county, Arizona. Undeveloped and idle.

WARREN REALTY & DEVELOPMENT CO. **ARIZONA.**

Office: 510 Lyceum Bldg., Duluth, Minn. Mine office: Bisbee, Cochise

Co., Ariz. Henry B. Hovland, president; Thomas F. Cole, vice-president and treasurer; Charles A. Duncan, second vice-president; Frederic R. Kennedy, secretary; Daniel R. Smith, assistant secretary; William G. Hegardt, assistant treasurer; Hoval A. Smith, general manager; Harvey P. Smith, chief clerk. Organized June 29, 1905, under laws of Arizona, with capitalization $900,000, shares $15 par; paid in, $12. Annual meeting, second Tuesday in April.

Lands, circa 1,700 acres, in the Warren district, all of possible mineral value, but mainly held for surface worth. The tract includes the Cunningham group, and the former holdings of the Calumet & Cochise Development Co., of which 3 claims are of much promise, and likely to make a mine. In June, 1905, the company had erected a gallows-frame, and planned vigorous sinking, the shaft showing some stringers of good ore.

The primary object of the company is to plat and sell lots in a new townsite, called Warren, 3 miles from Bisbee, and to operate street railways, water-works, a sewage system, etc., as the city of Bisbee is badly cramped for room, being built in a narrow gulch, and upon the flanks of precipitous hills. The new townsite, which is adjacent to a number of promising new mines, should prosper. Management is composed of experienced mining men, who are not likely to become blinded, by a flourishing realty business, to the mining possibilities of their holdings.

WARRIOR COPPER CO. ARIZONA.

Office: 316 Crozer Bldg., Philadelphia, Pa. Mine office: Black Warrior, Gila Co., Ariz. E. M. White, superintendent. Organized March 10, 1906, under laws of Delaware, with capitalization $1,600,000, shares $10 par, in $750,000 cumulative 7% preferred stock and $850,000 common stock. Has authorized a $150,000 bond issue, at 6%. Succeeded the Black Warrior Copper Co., Amalgamated, which came to grief financially.

Lands, circa 1,500 acres, in 3 groups, known as the Gold Gulch, Diamond H and Montgomery, latter including the Montana and Dadeville mines, adjoining claims, opened by tunnels of 1,000′ and 1,200′, with about 3,000′ of underground workings, showing a vein of 20′ to 60′ width, carrying silicious ores, assaying up to 6% copper. Has a steam plant, burning petroleum. Reduction plant includes a 100-ton concentrator, 50-ton matting furnace and 300-ton leaching plant, latter having six 50-ton square tanks, each 20x25′ and 5′ deep, in a building 62x130′. Tanks are heated by steam coils, facilitating lixiviation. Crushed ore is delivered to tanks from a railroad track, running above, which is to be replaced by a belt-conveyor. While this mine has large ore bodies, and has expended about $500,000 in development, it never became a steady producer. Property has been mismanaged, and its actual value, or lack of it, can be determined only by the test of operation, under a competent management. Early in 1906 the company was shipping 60 tons of ore daily, to the Old Dominion smelter, at Globe.

WARRIOR MINING CO. COLORADO.

Office: 622 Main St., Peoria, Ills. Mine office: Fort Garland, Costilla Co., Colo. Dr. L. D. Forman, president; Dr. W. M. Swartz, secretary. Lands, 26 claims and 2 millsites, claimed to show ore assaying up to 12% copper, 20

oz. silver and 2 oz. gold per ton, but from another source it is learned that at last accounts the company had not found ore in place, though the property is considered fairly well located.

WASATCH CONSOLIDATED MINING CO. **UTAH.**

Letter returned unclaimed from former office, Salt Lake City, Utah. Apparently was succeeded, 1905, by Wasatch King Mining Co.

WASATCH KING MINING CO. **UTAH.**

Office: Troy, N. Y. Mine office: Milford, Beaver Co., Wash. Employs 9 men. Joseph Leggett, president; Geo. E. DeFreest, secretary. Organized 1905, under laws of Utah, with capitalization $300,000, shares $1 par. Lands, 6 claims, area 120 acres, including the Wasatch King mine, near the Majestic, 10 miles northwest of Milford, opened by a 560′ tunnel.

WASHINGTON CO-OPERATIVE MINING SYNDICATE. **WASHINGTON.**

Mine office: Fairfax, Pierce Co., Wash. Lands, 2 claims, 17 miles by trail from Fairfax, said to show a 25′ vein, with 3′ paystreak carrying disseminated chalcopyrite, assaying 5% to 33% copper, 5 oz. to 8 oz. silver and $2 gold per ton. Has an available water power. Was in hands of a receiver, until company's coal lands, near Fairfax, were sold to the Western Iron, Coal & Coke Co. Idle for several years.

WASHINGTON COPPER & MILLING CO. **WASHINGTON.**

A rank fraud, promoted by the notorious L. E. Pike & Co., who are still permitted, by the federal postal department, to peddle worthless "mining" shares to the credulous public, from 294 Washington St., Boston Mass. These swindlers advertised the mine to be "the richest copper property in the United States, with even more flattering prospects than the Calumet & Hecla or United Verde." The "mine" consisted of 50′ shaft, bottomed in gravel.

WASHINGTON COPPER MINING CO. **MICHIGAN.**

Office: 60 State St., Boston, Mass. Operating office: care of Keweenaw Copper Co., Hancock, Houghton Co., Mich. Chas. A. Wright, president; preceding officer, James N. Wright and Spencer R. Hill, directors. Organized under laws of Michigan, with capitalization $2,500,000, shares $25 par; issued, $1,500,000. Ended 1905 with a cash balance of $2,822.25. Control was secured, 1906, by the Keweenaw Copper Co.

Lands, 1,050 acres, on the western shore of Mosquito Lake, Keweenaw county, Michigan, on which more or less desultory exploratory work has been done, during the past. Idle since 1901.

WASHINGTON COPPER MINING & SMELTING CO.

Office: 5 Tremont St., Boston, Mass. Apparently moribund.

WASHINGTON MINE. **CALIFORNIA.**

In Sections 30, 31 and 32, T. 2 S., R. 15 E., Tuolumne Co., Cal. Owned by W. E. & G. A. Hensley. Vein formation is diabase and meta-diabase. Was a small producer, at one time, but has been idle for some years.

WASHINGTON MINERAL MINING & SMELTING CO.

Office: 510 Bernice Blk., Tacoma, Wash. Apparently moribund.

WASHINGTON SMELTING & REFINING CO. **WASHINGTON.**

Works office: Keller, Ferry Co., Wash. Organized 1904, with capitali-

zation $1,000,000, shares $5 par, to build a smelter, at West Fork, on the Sans Poil river, 15 miles south of Republic, to treat the ores of the Belcher Mining Co. and adjoining properties.

WASHINGTON-SONORA GOLD & COPPER CO. **MEXICO.**

Office: care of A. Sandoval, treasurer, Nogales, Sonora, Mex. A. L. Lewis, president; Percy Sharpe, secretary and general manager. Organized 1902, under laws of Arizona, with capitalization $2,500,000, shares $5 par. Lands, 4 pertenencias, area 10 acres, in the Magdalena district of Sonora, Mexico, showing fissure veins and lenses in limestone, carrying a little native copper, and oxide and carbonate ores, giving estimated values of 18% copper, 12 oz. silver and $4 gold per ton, slightly developed by shafts and tunnels. Presumably idle.

WASHOE COPPER CO. **MONTANA.**

Office: 42 Broadway, New York. Mine office: Butte, Silver Bow Co., Mont. Employs 300 men. John D. Ryan, managing director; Wm. Skyrme, superintendent; J. B. Gallagher, superintendent sampling works; W. H. Price, foreman at Moonlight mine; Joshua Knight, foreman at Clear Grit mine; John Kane, foreman at Chambers mine. Capitalization $20,000,000, entirely owned by the Amalgamated Copper Co. Owns the Washoe smelter, which is leased to the Anaconda Copper Mining Co., and the Washoe Copper Co. owes $7,530,000 to the Amalgamated Copper Co., this being the amount borrowed to construct the Washoe reduction plant.

Lands, 37 acres, including the Moonlight, Clear Grit, Chambers, Washoe, Pacific, Oden and Gold Hill claims, mainly fractional. Company is operating the Moonlight, Clear Grit and Chambers mine. Miscellaneous landed holdings include 1,900 acres of Bear Creek coal lands, in vicinity of Red Lodge, Carbon county, Montana, also a coking coal property at Storrs, Gallatin county, Montana, and the company has a controlling interest in the Cokedale Coal Co., owning coal lands and 100 coke-ovens.

The Moonlight mine, which is the principal producer, has a 1,300′ three-compartment shaft, connected underground with the Blue Jay, Never Sweat, Anaconda and Pacific mines. The mine is timbered with 10x10″ square and round timbers, in square sets. Surface equipment includes a 20x48″ Dickson hoist, raising 2 double-deck cages with flat cables, also 2 Ingersoll-Sergeant air-compressors, of 50 drills aggregate capacity.

The Chambers mine has a 225′ two-compartment shaft, connected with the Dutton and Henry George mines, equipped with a 10x14″ hoist raising single-deck cages, and employs circa 80 men.

The Clear Grit mine has a 600′ two-compartment main shaft, with a winze 260′ below the bottom of the shaft, and is connected underground with the West Stewart and Mountain Consolidated mines. The Clear Grit employs 20 men and development was hampered, until 1906, by litigation with the Heinze interests.

The Washoe Copper Co. owns the Taylor & Brunton sampling works, at Butte, bought 1904. Production, at beginning of 1906, was said to be 425

tons daily, of ore averaging about 3.4% copper, and output of 1906 is estimated at 8,000,000 lbs. fine copper.

WASHOUGAL GOLD & COPPER MINING CO. **WASHINGTON.**

Office: 5312 Maple Ave., St. Louis, Mo. Mine office: Washougal, Clarke Co., Wash. Employs circa 30 men. F. A. Mabee, president; J. D. Wilcox, vice-president; J. B. Jordan and T. A. Altman, secretaries; Dr. Otta Sutter, treasurer; preceding officers constitute the directorate; A. D. Wright, general manager; Orrvis Wright, mine superintendent. Organized 1902, under laws of South Dakota, with capitalization $1,000,000, shares $1 par; issued, $920,000.

Lands, 560 acres, held on a 30-year state lease, well timbered, in the Bald Mountain district, near Mount St. Helens. Country rock is granite, showing several fissure veins of nearly vertical dip, of which one, under development by a 405′ tunnel, with 700′ of workings, is of 6′ estimated average width, giving ores assaying 5% to 20% copper, up to 15% lead and 15% zinc, 2 oz. to 77 oz. silver and $1 to $15 gold per ton. Has gasoline power, with hoists, 3-drill Leyner air-compressor and 7 mine buildings. For 1906 the management plans steady development, and the building of a concentrator. Company is free from debt, and seems to be developing along conservative lines.

WAUKEGAN & WASHINGTON MINING & SMELTING CO. **WASHINGTON.**

Letter returned unclaimed from former mine office, Bossburg, Wash.

WAYEHUTTE MINE. **NORTH CAROLINA.**

Owned by Carolina Copper Co.

WEILERTHALER BERGWERKE G. m. b. H. **GERMANY.**

Mine office: Markirch, Elsass, Germany. Dr. Recht, president; Jakob Siebenschuh, superintendent. Capitalization, 1,400,000 marks. Is a producer of silver, copper and antimony, ore being mainly tetrahedrite. Employed about 150 men, at last accounts.

C. WEISS y CA. **PERÚ.**

Office and mine: Nuevo Canete, Perú. Firm was a small producer of ores carrying gold, silver and copper, at last accounts.

WELDON GOLD & COPPER CO. **ARIZONA.**

Office: Tucson, Ariz. Mine office: Quijotoa, Pima Co., Ariz. Peter White, president; Jas. A. Green, vice-president; Ferris S. Fitch, secretary, treasurer and general manager; J. W. Giddings, superintendent; Fred Wall, mine superintendent; J. B. Tomlinson, engineer. Organized Jan. 26, 1901, under laws of Arizona, with capitalization $2,500,000, shares $1 par. Lands, 17 claims, area 340 acres, also a 10-acre millsite, in the Quijotoa district, 65 miles from the Southern Pacific railway, showing sundry contact veins between granite and andesite-porphyry, of which 5, of 12′ to 35′ average width, partially developed, show oxide and carbonate ores at surface and chalcopyrite at depth, latter being auriferous and associated with sphalerite, galena and iron pyrites, with brecciated quartz gangue, giving assays up to 22% copper. Openings include 5 shafts, deepest 300′, and 7 tunnels, 5 of which are crosscuts, longest being a 1,800′ crosscut tunnel, with total underground

openings of about 3,000′. The 1,800′ crosscut tunnel should not be included in the present workings of the Weldon, because driven many years ago, by previous owners, showing no ore,and running away from the Weldon workings, in addition to which it is abandoned and partly caved in. Has a 15-h. p. gasoline hoist and 4 power drills, with carpenter shop, machine shop, smithy, boarding-house, powder-house, assay office, store and 75x100′ mill with 20 stamps, of 100 tons daily capacity. The mill should not be included in the Weldon improvements, because two miles distant, built by former owners, antiquated, abandoned 20 years or so ago and bought by the Weldon company for $750, for the lumber, the equipment being junk. The officers are mainly men of high standing, and the directorate as a whole must not be held responsible for the somewhat misleading reports regarding the tunnel and mill.

WELLINGTON GROUP. **ARIZONA.**

Office: care of Woods Investment Co., Colorado Springs, Colo. Lands, 26 claims, area 125 acres, at Bouse's Camp, in the Plomosa district of Yuma county, Arizona, 18 miles east of the Colorado river and 2 miles south of the surveyed line of the Arizona & California railroad. The property is in a basin showing diorite, andesite, schist, limestone and sandstone, with occasional conglomerate and granite. The Bullion claim has a 124′ shaft, with crosscuts at 90′, showing 5′ to 10′ of ore, giving assays of 4% to 10% copper. Owners are awaiting construction of the railroad to begin active development,

WELSH COPPER MINING SYNDICATE, LTD. **WALES.**

Offices: 9, Fenchurch Ave., London, E. C., Eng. Mine office: Talybont, R. S. O., Cardiganshire, Wales. J. Bell-Irving, chairman; R. S. Corbett, managing director; W. H. Bartlett, secretary; James Stevens, consulting engineer. Organized Apr. 9, 1902, with capitalization £17,500, shares £1 par; issued, £17,207. Lands, 933 acres, including the Esgair Hir mine, carrying argentiferous sulphide ores of copper and lead, in two fissure veins of 40′ average width, claimed by company to average 3% to 10% copper, 4% to 5% lead, and 13 oz. silver per ton, opened by shafts of 150′ and 500′. Has a 40-ton concentrator. Idle for several years and property for sale.

WENDENDALE GOLD MINING CO. **ARIZONA.**

Has lands in the Cunningham Pass district, Yuma county, Arizona. Test shipments, early in 1906, to the Humboldt smelter, are said to have yielded 13% copper and $12 gold per ton.

WENDIGO COPPER CO., LTD. **MICHIGAN.**

Title changed, July, 1901, to Isle Royale Land Corporation, Ltd.

WENTWORTH MINE. **ARIZONA.**

Mine office: care of J. G. Wentworth, superintendent, Payson, Gila Co., Ariz. Idle.

WERDENHOFF MINING & MILLING CO. **IDAHO.**

Office: care of Hon. F. W. Hunt, president, Boise, Idaho. Stephen A. Powell, secretary; Horace E. Neal, treasurer. Capitalization, $5,000,000. Lands, 11 claims, in the Big Creek district of Idaho county, showing a mineral formation of about 250′ width, carrying mainly gold values, with a little lead and copper.

Property is claimed to show a 23′ vein, carrying 3% to 9% copper and $1.75 to $3 gold and silver, but average tenor of ore apparently is about 2% to 3% copper only, with correspondingly reduced gold and silver values. Equipment includes hoists, a 10-drill air-compressor and a 3-drill auxiliary compressor. The mine is reached by a 96-mile branch of the Oregon Short Line railway, running from Blackfoot to Houston, and is connected with the smelter by a 10-mile electric railway having a maximum gradient of 6%, in a rise of 2,000′. The electric equipment is said not to have proven economical in operation, and may be displaced by a Shay mountain-climbing locomotive.

The smelter had three 200-ton blast-furnaces, and was blown in September, 1902, but was closed down after a month's run. One stack was blown in again, October, 1903, but was closed down again. In November, 1903, the smelter was said to be treating 300 to 500 tons of ore daily, making therefrom, circa 15,000 lbs. fine copper, 800 oz. fine silver and 20 oz. fine gold, which would indicate smelter returns from ore of only 1.5% to 2.5% copper, and $1.75 to $2.75 gold and silver per ton. The furnace was partially dismantled, 1905, with the intention of removing it to Shasta county, California, but this attempt proved a fiasco, like every other move ever made by the White Knob, under its various titles. Discontinuing work in Idaho, and buying into a lawsuit in California, is the management's idea of how to run a copper mine. The most sensible thing the company has done yet was to lease its mine to Ravenal MacBeth. Of course a tributor gouges a mine—that's what he's there for—but any management whatever would be an improvement on the affairs of the White Knob.

The policy of the White Knob has been consistent in one thing only, that being the utter inconsistency of its management. Mine officials have been changed repeatedly, reorganization has followed reorganization, stock has been increased, decreased and bonds issued, authorized and redeemed. The smelter has been blown in, blown out and blown in repeatedly. Whether the mine is valuable or worthless nobody knows. Such a management would make a fist of it if given the Calumet & Hecla to manage. The best opinion seems to be that the mine has considerable ore, but is dangerously low in grade. The management of the White Knob should quit burlesque copper mining, and try running a chicken-ranch, or some other business suited to its ability.

WHITE KNOB COPPER & DEVELOPMENT CO., LTD. **IDAHO.**

A corporation, organized under laws of Maine, to take over the White Knob Copper Co., Ltd., being one of the links in the extremely weak chain of promotions of the White Knob mine.

WHITE KNOB MINING CO. **IDAHO.**

Reorganized, 1900, as White Knob Copper Co., Ltd.

WHITE PINE COPPER CO. **NEVADA.**

Dead. Property sold, circa 1905, to Nevada Consolidated Copper Co.

WHITE PINE MINE. **MICHIGAN.**

Office: care of Robt. Selden Rose, superintendent, Marquette, Mich. Lands, 80 acres, in the Porcupine Mountains, Ontonagon county, Michigan, 2

s V. Howard, secretary; W. C. McCurdy, general manager; Wm. Lynch, intendent. Organized July 25, 1900, under laws of Colorado, with capitation $750,000, shares $1 par.

Lands, 14 claims, area circa 290 acres, in the Uncompahgre district, 21 miles east of Grand Junction and 12 miles from Whitewater, the nearest ad point. Principal development on the Nancy Hanks claim, includes ' shaft, from which 17 cars of ore, shipped to smelter within past year, returns of 11% to 18% copper. Company is said to have built a n matting furnace, June, 1905, but nothing has been heard of the smelter , and presumably it is idle. Company paid regular quarterly dividends %, while peddling stock, and while the property is undeveloped promising, ompany is looked upon with suspicion.

T FORK GOLD-COPPER MINING CO. **IDAHO.**

A rank fraud, promoted by the notorious L. E. Pike & Co., of 54 Wash n St., Boston, Mass., who still are permitted by an inefficient government, nduct their swindling operations through the United States mails.

T GROUP. **BRITISH COLUMBIA.**

Mine office: Yreka, Vancouver Island, B. C. Lands adjoin the Yreka.

T LE ROI MINING CO., LTD. **BRITISH COLUMBIA.**

Compulsorily wound up, November, 1901.

STMORELAND COPPER CO. **NEW BRUNSWICK.**

Office: Dorchester, N. B. Apparently an erroneous title for Internial Copper Co.

ST MOUNTAIN MINING COMPANY, OF ARIZONA. **UTAH.**

Dead. Lands lost, and money refunded to those who bought stock of tem promoters. Apparently an honest failure.

ST QUINCY MINING CO. **UTAH.**

Office: Atlas Blk., Salt Lake City, Utah. Mine office: Park City, Sum- , Co., Utah. G. D. B. Turner, president and general manager; J. H. Moyle, e-president; R. E. Miller, secretary; Sherman Fargo, treasurer; preceding cers, J. H. Rand, Dr. E. V. Van Norman and W. H. Dodge, directors. ganized 1904, under laws of Utah, with capitalization $1,500,000, shares par. Annual meeting, second Tuesday after first Monday in May.

Property is a ⅜ interest, with an option on the remaining interest, in J. I. C. mine, lands, 5 claims. Development is by a 600′ two-compart- nt vertical shaft, and by a crosscut tunnel through property of the Little ll mine, begun December 1, 1904, which cut a contact vein, giving assays to 20% lead, 160 oz. silver and $2 gold, and it is expected that the main body will be cut at depth, giving a back of 750′, and that the Daly West ntact vein will be cut at depth, giving a back of 900′. Considerable trouble s been had from shifting ground and a heavy inflow of water.

ESTRALIAN COPPER MINE, LTD. **AUSTRAI**

Reorganized, circa 1899, as Balla Balla Copper Mines, Ltd.

EST ST. DAVID'S GOLD & COPPER MINES, LTD. **.V**

Offices: 156, Leadenhall St., London, E. C., Eng. Capital

WILTON MINING & MILLING CO. **ARIZONA.**

Office: 615-87 Washington St., Chicago, Ills. Mine office: Huron, Yavapai Co., Ariz. W. A. Buchanan, president; F. W. Park, vice-president and secretary; Victor Schill, treasurer; Milo Schill, general manager; preceding officers and Thos. McSteel, directors. Organized 1902, under laws of Arizona, with capitalization $1,200,000, shares $1 par. Company is said to be free from debt. Lands, 3 claims, area 60 acres, in the Big Bug district, said to be only one half-mile from the Humboldt smelter. Property shows fissure veins carrying auriferous copper ore, opened by 4 shafts, deepest 50′, and by a 220′ tunnel, on the strength of which openings the company estimates 1,000,000 tons of $50 ore blocked out, which is absolutely impossible. From the million tons claimed to be blocked out, the company has managed to extract about 75 tons, which ore is on the dump, and at this rate of production the million tons will last a long time. Company has secured ores assaying 19.5% copper, 3 oz. silver and $4.30 gold per ton. The officers are men of good standing, and the management seems honest, but utterly inexperienced, and its ridiculous claims regarding the amount of ore blocked out must injure its standing.

WINDFALL MINING CO. **WASHINGTON.**

Mine office: Chewelah, Stevens Co., Wash. C. T. Rigg, superintendent, at last accounts. Ores carry gold, silver, lead and copper. Presumably idle.

WINNEBAGO MINING CO. **COLORADO.**

Mine office: Central City, Gilpin Co., Colo. Ores carry gold, silver and copper. Has steam power.

WINNIPEG MINES, LTD. **BRITISH COLUMBIA.**

Letter returned unclaimed from former mine office, Phœnix, B. C. John Dean, president; Richard Plewman, secretary, treasurer and general manager. Bankrupt, in all likelihood.

WINNIPEG MINING & MILLING CO. **WASHINGTON.**

Mine office: Republic, Ferry Co., Wash. Geo. L. Moody, superintendent. Lands include the Hawkeye mine, near the Belcher, presumably carrying the same grade of ore. Is said to have ordered an 8-drill electric plant, and to plan using power from the Belcher electric installation.

WINONA COPPER CO. **MICHIGAN.**

Office: 199 Washington St., Boston, Mass. Mine office: Winona, Houghton Co., Mich. Employs circa 100 men. Arthur G. Stanwood, president; J. Wheeler Hardley, secretary; John R. Stanton, treasurer; preceding officers, Chas. J. Paine, Wm. A. Paine, Nathaniel H. Stone and James H. Seager, directors. Dr. L. L. Hubbard, general manager; Rex R. Seeber, superintendent; Wm. H. Charlton, clerk. Organized 1898, under laws of Michigan, with capitalization $2,500,000, shares $25 par. Paid in, $11. Last assessment was $1, February 25, 1906. Is closely allied, in ownership and management, with the Challenge and King Philip mines, under control of St. Mary's Mineral Land Co. Boston Safe Deposit & Trust Co., registrar; American L an & Trust Co., Boston, transfer agent. Shares are listed on the Boston Stock Exchange. Annual meeting, last Tuesday in March. Expenditures

-drill Rand compound air-compressor, driven by a 300-h. p. electric motor. has 30 gravity stamps, with double-discharge mortars, 6 Wilfley con- rating tables and a 4-unit Elmore oil concentrator. Production was 2,000 tons of ore, 1904. Presumably idle.

ITE EAGLE COPPER MINING CO. TEXAS.

Dead. Lands sold to pay company's indebtedness.

ITE EAGLE MINING CO.

Has lands in the vicinity of Empire Flats, on the Colorado river, near the Williams Fork river, presumably in Yuma county, Arizona, but possibly in Bernardino county, California, and in 1906 planned joining other com- ies in that vicinity in building a small smelter, on Empire Flats.

ITE HORSE MINING CO. ARIZONA.

Office: 20 Broad St., New York. Lands, 200 acres, in Yavapai county, ona. Idle for several years.

ITE KNOB COPPER CO., LTD. IDAHO.

Office: 36 Wall St., New York. Mine office: Mackay, Custer Co., Idaho. ry J. Luce, president; Wilbur K. Mathews, vice-president; Chas. G. Funk, etary; Chas. B. Van Nostrand, treasurer; A. M. Poole, assistant secretary treasurer; preceding officers, E. C. Platt, E. Roscoe Mathews, E. B. Sheldon J. R. Foster, directors; Frank E. Leland, mine superintendent; Ravenel cBeth, manager, under lease. Organized, originally, under laws of West ginia, as the White Knob Mining Co., with capitalization $5,000,000; rganized, with present title, April 24, 1900, under laws of New Jersey, with italization $12,500,000; again reorganized, January, 1903, under same rter and title, with capitalization $2,000,000; again reconstructed, 1904, h capitalization $2,600,000, shares $10 par; issued $1,600,000. A further rganization, planned December 6, 1904, provides for a $3 assessment on ck, upon payment of which old shareholders should receive 30% preferred 170% common shares of a new issue. Nathan H. Clark and W. K. Mathews e appointed receivers, October 1, 1904. Debentures $500,000, in 10-year king-fund gold bonds, at 6%, due 1913. On March 2, 1904, company horized an issue of $1,000,000 of 6% convertible sinking-fund gold bonds, organization plan calls for a new company, with $6,000,000 capitalization, res $10 par, in $2,000,000 cumulative 7% preferred, and $4,000,000 com- n shares, giving bondholders new stock at par, with a bonus of 233% in mmon stock. Annual meeting, first Tuesday in January.

The company endeavored to purchase control of the Balakalala Con- idated Copper Co., but the control of the Balakalala was sold twice, and ldings of 50,000 shares of Balakalala are said to have been sold, February, 06, at an average price of about $9 per share. The company has expended ,000,000, in Idaho, to very poor advantage.

Lands, 32 claims, 3 millsites, the 90-acre townsite of Mackay, sundry mber lands, water-rights and right-of-way for an electric line, all in the st River Valley, with an area of circa 2,100 acres. The main shaft is 0′ deep, connecting with the Albert tunnel, about 1,500′ long, and mine has rea 6 miles of workings, with considerable ore blocked out for stoping.

cious stoping and reasonable selection of ground broken. Equipment at No. 2 includes a hoist good for 1,500′, a 29x70′ steel shafthouse and a 40x50′ steel rockhouse, 106′ high.

No. 4 shaft, circa 1,500′ south of No. 3, near the southern line, is sunk on ground secured from the King Philip in rectifying the boundary lines. The shaft is sunk in the footwall, and is being opened by simultaneous sinking and raising, which is possible by reason of the long drifts from No. 3 having opened ground tributary to No. 4.

Old No. 3 shaft, now idle, 900′ north of No. 2 and about 750′ deep, shows little ground of promise. Old No. 4, the northernmost shaft, is about 1,350′ northeast of No. 1 and also is idle, having found nothing of importance. Old No. 5 shaft was started on a wide amygdaloid bed, located by diamond drill, but did not develop good ground, and was discontinued at slight depth.

The mine employed 7 power drills, at the end of 1905, of which 2 were sinking and 5 drifting. The mine has about 4 miles of underground openings, and apparently the southern end of the property will make a mine, the showing to the north averaging poor.

The engine-house, located midway between shafts 1 and 2, is 40x40′, of steel frame on stone foundations with corrugated iron siding and roof. This building contains 2 hoists, each good for 1,500′ depth, operating Nos. 2 and 3 shafts, also an Ingersoll-Sergeant "Class A" two-stage straight-line 12-drill air-compressor, and a smaller single-stage compressor. Adjoining is a boiler-house, 40x48′, of steel on stone foundations, with iron siding and roof, housing four 80-h. p. boilers. Other mine buildings are a 34x48′ combination engine and boiler house, 26x40′ warehouse, 20x40′ carpenter shop, 22x34′ smithy, 30x40′ store building, office building, two boarding-houses, 16 frame dwellings and 9 log houses, the dwellings being built in a townsite platted by the company. The Winona also has a sawmill, 30x70′, with a 42x66′ wing for boilers, and a 16x46′ wing containing a shingle mill, the plant having a daily capacity of 20,000′ of sawed lumber. The main line of the Copper Range railroad passes near the mine, and a spur has been built to No. 2 shaft.

Production was begun, with one leased stamp, at the Atlantic mill, in December, 1902, and continued for nearly two years. This work was in the nature of an extensive test, although the Winona made 1,036,944 lbs. fine copper in 1903, and 646,025 lbs. in 1904. The results indicate that the property has the making of a mine, the returns being 18.95 lbs. fine copper, per ton stamped, in 1904. Milling was discontinued about Nov. 1, 1904, and all energies bent toward opening the mine, no copper being made in 1905. It is planned to resume production, probably with one leased head at the Adventure mill, before the close of 1906. The mine has a good management, and will be given every opportunity to prove itself a profitable producer.

WINONA GOLD-COPPER MINING CO. **WYOMING.**

Office: 681 Grant Ave., Denver, Colo. James R. Saville, president and treasurer; Henry F. Tower, secretary. Organized under laws of Wyoming, with capitalization $5,000,000, shares $1 par. Lands, 23 claims, area 475

s from the [illegible]. Lands are owned by the [illegible] company. [illegible] ed in the lode. [illegible] of prospecting with [illegible]

ITE PINE MINE. [illegible]

Office and mine [illegible] Mont. A [illegible] per has been [illegible]

ITE ROCK COPPER MINING CO. [illegible]

Office: Ellsworth Bl[illegible]. Mine office [illegible] rill, president. [illegible] s, with authorized [illegible] th of 100. Mine [illegible] ther shipments 190[illegible] ns of 20[illegible], copper and [illegible] ch, 1906, property [illegible]

ITE TANKS MINING [illegible] [illegible]

Office: 740 Land Title Bldg., Philadelphia. [illegible] ined from former mine office. Property [illegible] White Tanks Mountains, [illegible] 40 miles west of Phoenix, Maricopa [illegible] sota. Apparently inactive.

ITNEY REDUCTION CO. [illegible]

Mine office: Gold Hill, Nevada Co., N. C. [illegible] Idle.

ICKENBURG SMELTING & REDUCTION CO. [illegible]

Dead.

ICKES-CORBIN COPPER MINING CO. [illegible]

Offices: care of J. A. Beyer, Chicago, Ills., and 24 East Broadway [illegible]tte, Mont. Letter [illegible] from former mine office, Corbin, [illegible]fferson Co., Mont. Organized 190[illegible] with capitalization $1,000,000, shares par, as successor of Colorado Mining & Development Co. Lands [illegible] ims, including the Hidden Treasure and Copper Queen groups, carrying [illegible]riferous and argentiferous copper ores.

TLD BILL MINE. MONTANA.

Owned by Anaconda Copper Mining Co.

TLLIE BOY MINE. OREGON.

Mine office: Comer, Grant Co., Ore. Presumably idle.

TLL SMELTING CO. ARIZONA.

Office: 218 Fleming Block, Phoenix, Ariz. Works offices: Wickenburg, aricopa Co., Ariz., and Quartzite, Yuma Co., Ariz. Joseph Boyer, superintendent. Property includes a 40-ton custom smelter, general store and otel at Wickenburg, and a 50-ton furnace at Quartzite, also 5,400 acer ground, near Quartzite.

TLMOT MINING CO.

Office: Ontonagor, Mich. W. H. Garlick, president. Land ghts only, to 3,520 acres, in Ontonagon county. Idle.

WOLCOTT COPPER MINING CO. **VERMONT.**

Mine office: Wolcott, Lamoille Co., Vt. Organized, circa 1900, with capitalization $500,000, shares $1 par. Idle.

WOLFRAM COPPER CO. **ARIZONA.**

Office: care of Benj. Blanchard, general manager, Prescott, Ariz. Lands, sundry claims, in the Bill Williams Fork river district of Yuma county, Arizona, near the line of the Arizona & California railroad.

WOLVERINE & ARIZONA DEVELOPMENT CO. **ARIZONA.**

Reorganized, March, 1904, as Wolverine & Arizona Mining Co.

WOLVERINE & ARIZONA MINING CO. **ARIZONA.**

Office: Calumet, Mich. Mine office: Bisbee, Cochise Co., Ariz. John Daniell, president; Paul P. Roehm, vice-president; W. Frank James, treasurer; F. C. Fenner, managing director; preceding officers, W. H. Brophy, Fred Braastad, Thos. Maslin, Edw. Ulseth, B. F. Chynoweth and Arthur E. Delf, directors; W. R. Oates, secretary; W. H. Roberts, clerk and superintendent pro tem. Organized 1904, under laws of Arizona, with capitalization $3,000,000, shares $15 par; issued 96,654 shares.

Lands, 9 claims, area circa 160 acres, claims being known as the Cairo, Memphis, Kentucky, Georgia, Louisiana, Chicago, Warren, George and Broken Promise. The Georgia claim lies about 600′ from the lands of the Calumet & Arizona, and about 3,000′ from the Irish Mag shaft of the Calumet & Arizona and the Spray and Holbrook shafts of the Copper Queen, three of the richest shafts in the Warren district. The Uncle Sam and White Tail Deer mines of the Copper Queen are adjacent to the Wolverine & Arizona holdings, and leasers have taken rich ore from the White Tail Deer about 800′ from the Wolverine shaft, which is 700′ deep, with three compartments, each 5′x4′6″ and well timbered, cutting limestone showing considerable iron. The shaft has proven very wet at depth, and has No. 7 and No. 9 Cameron sinking pumps and a 500-gallon Prescott station pump. A drift on the 500′ level runs 850′ toward the Pittsburg & Duluth, cutting leached ore and ledge matter carrying traces of copper, and drifts run in other directions show encouraging quantities of leached material, but no ore of workable grade had been developed up to Sept. 1, 1906.

Surface equipment includes a 260-h. p. steam plant, 2 single-drum hoists, a 6-drill air-compressor, 25x50′ engine-house, office, bunk-house, boarding-house and a 10,000-gallon water tank, water being pumped from Naco, 8 miles distant. A large stock of timber and other supplies is carried. The final bond payments do not fall due until Jan. 31, 1907, and most of the payments due on bonds have been taken in stock. The Wolverine & Arizona lands are considered promising.

WOLVERINE COPPER MINING CO. **MICHIGAN.**

Office: 15 William St., New York. Mine office: Kearsarge, Houghton Co., Mich. Employs circa 500 men. Jos. E. Gay, president; J. Wheeler Hardley, secretary; John R. Stanton, treasurer; preceding officers, Joseph W. Howe and Samuel L. Smith, directors; Fred Smith, superintendent; Willard J. Smith, assistant superintendent; Chas. Noetzel, clerk; Wm. Pollard, min-

ing captain; B. S. Shearer, mill superintendent; F. Wm. Hartmann, engineer; A. B. Holtenhoff, master mechanic. Organized 1890, under laws of Michigan, with capitalization $1,500,000, shares $25 par. Has paid dividends of $2,430,000 to end of 1905, and paid a semi-annual dividend of $480,000 on April 1, 1906. Fiscal year ends June 30. Adams Trust Co., Boston, registrar, American Loan & Trust Co., Boston, transfer agent. Annual meeting, first Monday in August.

Official returns to the state of Michigan, as of date Jan. 1, 1905, disclose the following figures:

Amount of cash paid in on capital stock	$780,000.00
Amount paid in by conveyance of property	550,000.00
Entire amount invested in real estate	720,665.23
Amount of personal estate	812,370.93
Amount of floating debt	72,215.34

The following table gives comparative figures for three fiscal years ending June 30:

	1902	1904	1906
Mineral production, pounds	6,232,800	12,152,590	12,268,135
Copper production, pounds	4,984,367	9,300,695	9,681,706
Gross proceeds	$658,602	$1,192,425	$1,662,142
Expenditures at mine	364,093	495,655	529,668
Smelting and miscellaneous	60,236	105,033	99,729
Construction and lands	264,678	34,496	35,968
Net mining profit	—30,405	591,736	996,776
Interest received	6,731	6,679	11,044
Total net profit	—23,674	557,240	1,007,820
Dividends	240,000	390,000	840,000
Balance	—263.674	+167,240	+167,820
Rock hoisted, tons	213,650	328,412	355,339
Rock stamped, tons	187,482	314,091	341,820
Yield of rock treated per ton, lbs.	26.590	29.610	28.320
Cost per ton of rock hoisted	$ 1.700	$ 1.510	$ 1.490
Cost per ton of rock stamped	.940	1.580	1.540
Cost per pound of refined copper at mine, cents	7.304	5.329	5.470
Cost of smelting and miscellaneous, cents	1.208	1.129	1.030
Total cost of refined copper, including construction, per pound, cents	13.820	6.869	6.760

The mine was opened, 1882, by local capital, but was not successful, and the company was reorganized, 1890, with the present title and management, when new machinery was secured and work resumed. The previous ill-success of the mine rendered investors dubious of its future, and cash for its development was secured with difficulty. Lack of funds imperatively demanded for the operation of the property was met by Mr. John Stanton, with

a heavy loan, advanced from his own pocket, at a time when other shareholders were unwilling to risk a dollar, and it is due to Mr. Stanton's courage that the Wolverine now is, in proportion to its size, the most profitable copper mine in the Lake Superior district. Under Mr. Stanton's management milling was discontinued immediately, and was not resumed until 18 months of underground development had given adequate reserves of stamp-rock. By reason of the sound policy pursued, the mine began making small profits from the time that stamping was resumed, in 1892, and ever since has enjoyed a steady growth in productive capacity and earning power.

Lands, 280 acres owned in fee, and 40 acres of adjoining mineral rights, giving 3,100′ of the outcrop of the Kearsarge amygdaloid bed, on which the mine is opened. The neighbors of the Wolverine are the North Kearsarge on the north, Mayflower on the east, Mayflower and South Kearsarge on the south and Centennial on the west. The lode averages about 16′ width, with an average dip of 41°, and is bunchy, but carries the best average values of any amygdaloid mine in the Lake Superior district, returning 28 to 30 lbs. fine copper per ton of rock stamped, as compared with 16 to 17 lbs. only, in 1892.

The mine has 4 shafts, numbered from north to south. No. 1, near the North Kearsarge line, ran into the boundary at shallow depth, and tributary ground was worked out and the shaft abandoned some years ago.

No. 2 shaft, permanently bottomed at 1,700′, is used exclusively for handling men and material. Stringers are being replaced by cross-ties, similar to those on the roadbed of a railway, following the plan of the Calumet & Hecla, and eventually cross-ties will replace stringers in shafts 3 and 4.

No. 3 shaft, sunk in the footwall, is circa 2,800′ deep, and can be sunk to 4,300′ depth, owing to exchange of lands with the North Kearsarge mine of the Osceola. In this shaft stoping is in progress on the 12th to 24th levels, inclusive. The wooden shaft-rockhouse at No. 3 was burned, March, 1906, and has been replaced by a new steel structure, which is a duplicate, in design and equipment, of the shaft-rockhouse at Mohawk No. 4 shaft.

No. 4 shaft, 2,600′ deep, is sunk 45′ in the footwall, a wise provision that guards the shaft against the serious dangers threatening all deep shafts of the Lake Superior district that are sunk on the cupriferous beds, which lack the strength of the alternating strata of solid trap. In No. 4 stoping is in progress on the 6th level, and from the 11th to 24th levels, inclusive. A new stone engine-house is being built for No. 4, and this will have a winding engine duplicating that at Mohawk No. 4 shaft. The new hoist will be a 24x60″ Nordberg, duplex-cylinder engine, with double conical drum of 18′ maximum diameter, capable of raising 4-ton skips from one mile depth, and will serve the shaft for its ultimate depth of 4,400′.

Owing to the uniformity of the copper-bearing bed, all levels from the first to the 23d, inclusive, are opened though, connecting with all four shafts to depths of Nos. 1 and 2, and with the Nos. 3 and 4 only below the 17th level, those being the only shafts deeper than 1,700′. Man-cars are installed at shafts 2, 3 and 4. The mine employs 27 power drills, of which 18 are stoping

and 9 sinking and drifting. Notwithstanding only one-third of the drilling capacity being employed on opening work, the mine is fully opened for about 6 years' production, at the present rate of circa 10,000,000 lbs. fine copper yearly. About one mile of new openings are made yearly, and the mine has about 25 years of life remaining, at the present rate of output.

Lying about 80' west of and parallel with the Kearsarge bed is the West lode, opened by a crosscut on the 11th level. A little work was done on the West lode in 1903, and one excellent stope was opened, but the prospects of making a paying mine on this bed are not especially bright, as it would be contrary to all precedent were two parallel beds so close together to be found payable. An exploratory crosscut, on the 11th level, driven 2,000' across the formation, both east and west from the workings on the Kearsarge bed, reached as far west as the Kearsarge conglomerate, which was absolutely barren, where cut. The west lode gave a little encouragement in the 14th level crosscut, and may be tested further. The Kearsarge conglomerate carries some copper on the Ahmeek and Seneca properties, to the southward.

A new system of underground rock-handling is proving an unalloyed success. By this plan, an average of 10 tram-cars is kept on each level. Trammers leave the full cars at the shaft, and 2 men attend to the dumping in each shaft. These men start at the topmost level where stoping is in progress, and work downward, dumping all the loaded cars on each level, in order, then ride up, to the topmost producing level, on the skips, and repeat the process already described. By this simple system all signalling in each shaft is in the hands of two men, the engineers in charge of the hoists know exactly what is going on underground, much confusion is saved, the trammers lose no time at the shafts, and perfect order reigns. Simple as this little plan may seem to a layman, it will appeal strongly to mine managers throughout the world, and is certain to come into general use, eventually, in most mines with inclined shafts and heavy production, where underground ore-bins are not employed.

Surface equipment is well adapted to present and future needs, the principal buildings being at No. 4 shaft. The boiler-house, at this point, has 3 Stirling water-tube boilers, an American automatic stoker, and a Green fuel economizer. The Rand air-compressors are of 20-drill and 22-drill capacity. No. 3 shaft has a model changing house, much appreciated by the miners. The hoists at shafts 2 and 3 have straight-face drums and duplex cylinders. The shafthouses are substantial and equipped with necessary crushing machinery. A private telephone system reaches the underground pump-stations and the principal buildings on surface. The company owns a large number of good dwellings, and the mine location is exceptionally neat and prosperous in appearance.

Rock goes to the mill over the Mohawk & Traverse Bay railroad, with a down-grade haul of 13 miles. The mill, completed 1902, is near the mouth of the Tobacco river, on Traverse Bay, Lake Superior, and adjoins the Mohawk mill, both being served by a single pump and managed by a joint superintendent, this arrangement allowing considerable operating economies. The mill,

of steel, on stone foundations, 180x206′ in size, stands 37′ above lake lev giving a good drop for tailings, with ample room for sands. There are Nordberg heads striking about 110 blows per minute, with a capacity about 550 tons daily, each. The mill has a full complement of jigs and mak extensive use of Wilfley tables. Mineral from the heads and wash is sluic to the basement through iron pipes, and is sent for reduction to the works the Michigan Smelting Co. at Houghton. The boiler-house, just south of t mill, is 42x58′ with stone walls and steel truss roof, housing a battery 200-h. p Stirling water-tube boilers, fitted with automatic stokers. Coal g through a lump-crusher, thence to hoppers having 24 hours' storage capacit A completely appointed machine shop is maintained in connection with t mill. A 20,000,000-gallon horizontal triple-expansion Snow pump, owned an operated jointly by the Wolverine and Mohawk, has steam cylinders of 18 33″ and 54″ diameter, and 22″ water plungers with 36″ stroke, and is to be aide by an 8,000,000-gallon Nordberg pump with triple-expansion water-end an 3 plungers. The pump-house is located on the river, near its mouth, the in take pipe being protected by timber cribs running 300′ into the lake, to pre vent clogging from floating bark and anchor ice. The coal and merchandis wharf, owned jointly by the mines, is near the mill, and is fitted with coa hoists. A 40-acre townsite, platted near the mills, is named Gay, in deserve honor of Jos. E. Gay, the president of the company.

The death of John Stanton, Feb. 23, 1906, deprived the Wolverine, no only of its president, but of the father of the property. But for his fosterin care, at a critical period, the Wolverine would be today a property twice di credited by failure, instead of a mine that netted a million dollars cash in t fiscal year ending June 30, 1906. Fortunately the management of the co pany remains in the hands of the men who have been closely associat with Mr. Stanton for many years past, and the policy will be absolutely u changed.

Production, for the calender year 1905, was 9,464,418 lbs. fine copper, a for the fiscal year ending June 30, 1906, was 9,681,706 lbs., compared w 9,729,971 lbs. for the preceding fiscal year, a decrease of 48,265 lbs., equival to almost exactly one-half of one per cent. The Wolverine has but two p ductive shafts, and the use of one of these was lost, for the last four month the fiscal year, yet production was maintained by the single shaft. This me that the Wolverine mine is capable of making twice its present output, if sired, by doubling the milling facilities, but no movement toward such crease has been made. The management of the Wolverine, both general a local, is as nearly perfect as that of any mine in operation.

WOLVERINE MINE. COLORA

Owned by Coldwater Copper Mining Co.

WOLVERINE MINING CO. UT

Office: Superior Savings Bank Bldg., Hancock, Mich. Letter retur unclaimed from former mine office, Park City, Summit Co., Utah. Capi ization, $150,000, shares $1 par. Chas. A. Wright, president; Martin Effinger, vice-president; Lewis A. Jeffs, managing director. Lands, 11 clai

area circa 125 acres, about one-half mile south of the Daly Judge, in the Snake Creek district, developed by tunnel, with about one mile of underground openings, showing 6 veins of 1′ to 6′ width, carrying auriferous and argentiferous sulphide ores of lead and copper, averaging $8 to $10 per ton, mine-run, with occasional antimonial silver, assaying as high as 564 oz. per ton, and with considerable shipping ore, carrying values from $50 up to $80 per ton. Working tunnel has cut 2 ore bodies, one a 2′ vein carrying 4% copper, 4% lead and 80 oz. silver per ton. Idle.

WOLVERINE MINING & LEASING CO. **COLORADO.**

Office: care of Dr. Z. L. Baldwin, president, Niles, Mich. Mine office: Pearl, Larimer Co., Colo. Burr T. Lobdell, treasurer and chairman of executive committee. Is a development company, composed of shareholders of the Coldwater Copper Mining Co., and is operating the Coldwater copper mine, under a three to five year lease.

WOLVERINE & WESTERN MINING CO. **OREGON.**

Office: care of James T. Fisher, president, Calumet, Mich. Dr. D. K. McQueen, vice-president; Frank J. Kohlhaas, secretary and treasurer; Capt. Thos. Buzzo, superintendent; preceding officers, Johnson Vivian, Jr., Wm. Harris and Geo. Hall, directors. Organized circa 1905, under laws of Arizona, with capitalization $100,000, shares $10 par.

Lands, 8 claims, area 160 acres, held under option expiring March 31, 1907, in Coos and Douglas counties, Oregon, 18 miles from a railroad, 45 miles from Roseburg and circa 50 miles north of Grants Pass, in an absolutely new district, where no mining has been attempted previously. Country rocks are granite and porphyry, showing an 18′ vein carrying chalcopyrite, giving average assays of 15.7% copper, and a vein carrying a 40″ paystreak of massive bornite, assaying 40% to 60% copper. Development is by a 150′ tunnel, cutting both veins, and a second tunnel was started, 1906. Equipment includes power drills. Management plans pushing work vigorously, and property is considered decidedly promising.

WOOD RIVER GOLD & COPPER CO.

Letter returned unclaimed from former office, Scranton, Pa. Organized 1902, under laws of Delaware, with capitalization $1,000,000, by W. W. Watson, et al.

WOODSIDE-EUREKA MINING CO. **CALIFORNIA.**

Office: Bacon Blk., Oakland, Cal. Mine office: Georgetown, El Dorado Co., Cal. W. E. Everson, superintendent. Organized circa 1906, as a reconstruction of El Dorado Copper Mining Co., with capitalization $500,000. Lands, sundry quartz and placer claims, area circa 200 acres, including the Eureka and Woodside mines, with principal development on the Eureka, which has shafts of 100′ and 250′ depth. Lands are said to carry gold, copper and asbestos. The prospectus of the old company contained a vast amount of varied misinformation.

WOOLLEY MINING CO. **ARIZONA.**

Mine office: Kelvin, Pinal Co., Ariz. Lands, 17 claims, between the Saddle Mountain and Troy-Manhattan, held under a $60,000 bond and lease.

WORLD'S FAIR MINE. **ARIZONA.**

Office: care of Frank Powers, owner, Nogales, Ariz. Lands, sundry claims, near Harshaw, in the eastern end of the Salero Mountains, Patagonia district, Santa Cruz county, Arizona. The mine is said to have circa 2 miles of workings, deepest 550′, on an 8′ ore body, showing mainly lead carbonates and sulphides, carrying good silver values near surface, changing principally to auriferous copper sulphides at depth. Property has been a shipper of high grade ores, in carload lots, for some years, ores ranging in value from $250 to $350 per ton, one carload of 20 tons netting $15,000, and is popularly reputed to have produced upwards of $500,000.

WRIGHT & LAWRENCE MINING CO. **CALIFORNIA.**

Office: 8 Jackson Blvd., Chicago, Ills. Eric Forsell, president; R. M. Smith, secretary; A. W. Linquist, general manager. Lands, 16 claims, area 320 acres, in the Doyle district, Riverside county, California. A rotten stock-jobbing concern.

WRIGHT-RUSSELL COPPER MINING CO. **WYOMING.**

Letter returned unclaimed from former mine office, Battle, Wyo.

WYACCA MINE. **AUSTRALIA.**

Office: care of E. Pearce, Broken Hill Chambers, Adelaide, South Australia. Lands are in the Hundred of Basedow, in the Flinders range, 8 miles southwest of the Blinman mine, and about 260 miles north of Adelaide. Vein ranges 1″ to 26″ wide, carrying cuprite, melaconite and chalcopyrite, in a gangue of calcspar and spathic iron. Idle at last accounts.

WYANDOT COPPER CO. **MICHIGAN.**

Office: 68 Devonshire St., Boston, Mass. Mine office: Winona, Houghton Co., Mich. Henry Stackpole, president; Irving J. Sturgis, vice-president; Wm. O. Gay, secretary and treasurer; preceding officers, Joseph Dorr and Mathew Van Orden, directors; Frank L. Van Orden, superintendent. Organized 1899, under laws of Michigan, with capitalization $2,500,000, shares $25 par; paid in, $9. On April 1, 1906, had a cash balance of $18,213, with $28,263 accounts receivable, and a net surplus of $49,408, with $14,408 due the company on assessments. Old Colony Trust Co., Boston, registrar. Annual meeting, first business day of May.

Lands, 1,040 acres, adjoining the Winona, in Sections 16, 20 and 21, Town 52 North, Range 36 West, Houghton county, Michigan. Tract is crossed by the Copper Range railroad. Exploratory work, begun February, 1899, has been continued uninterruptedly, though hampered by the great disadvantage of a heavy overburden. Early work was done in search of the Winona lode, and efforts were made later to locate the southern extension of the Baltic amygdaloid, but attention was again turned to the Winona lode.

No. 1 shaft, circa 600′ deep at end of 1905, is on the Winona lode, with a parallel underlying amygdaloid bed 60′ distant, both broken and of little promise, though showing occasional patches of well-mineralized ground. It is planned to sink to a depth of 1,000′ and then drift on the lode. The shaft is in the footwall and the lode is reached by crosscuts therefrom. Shaft No. 11, about a quarter-mile from No. 1, and 100′ deep, shows a disturbed and unsatisfactory

formation, with parallel amygdaloids 50′ apart, these giving only occasional bunches of good ground. A 102′ shaft was sunk on a lean cupriferous conglomerate underlying the Winona bed, and a 300′ shaft sunk on an amygdaloid identified as the Elm River gave no promising ground. A crosscut was sent eastward, 1904, to the Eastern Sandstone, and also several hundred feet westward, cutting several amygdaloids carrying copper in small quantities, on which a little drifting was done, but nothing of promise found. It is thought that the Baltic lode was one of the amygdaloids located in the western crosscut, but the lode in question was very wide, and void of copper. Some work was done, September, 1904 to April, 1905, on the Misery River lode, in Section 16, Town 52 North, Range 36 West, on a 20′ amygdaloid carrying fine copper, but nothing of value was developed. In addition to opening work, extensive diamond drill borings have been made, but results have been of a negative nature. To date the Wyandot has found nothing workable, but operations are being continued, along well-considered lines, and the property will not be abandoned until it has been given an exhaustive test. The geological conditions of the Lake Superior copper district are such that a vast amount of work is necessary to thoroughly exhaust the possibilities of any given tract, and the management is following the only correct plan by continuing its exploratory work. Surface improvements include machine and blacksmith shops, warehouse, barns, and about 12 dwellings, with boilers, hoists, shop machinery and tools.

WYOMING & ALABAMA MINING CO. **WYOMING.**

Letter returned unclaimed from former mine office, Tie Siding, Wyo.

WYOMING & COLORADO COPPER CO. **COLORADO & WYOMING.**

Said to have lands in the Douglas Mountains, 125 miles south of Rock Springs, Sweetwater county, Wyoming.

WYOMING CONSOLIDATED COPPER CO. **WYOMING.**

Letters returned unclaimed from former office, 27 State St., Boston, Mass., and former mine offices, Encampment and Collins, Wyoming.

WYOMING COPPER CO. **WYOMING.**

Letter returned unclaimed from former mine office, Encampment, Carbon Co., Wyo. Lands were on upper Cow Creek.

WYOMING COPPER & GOLD MINING CO. **WYOMING.**

Office: Alma, Kansas. C. B. Henderson, manager, at last accounts.

WYOMING COPPER & MINING CO. **WYOMING.**

Office: 115 Dearborn St., Chicago, Ills. Mine office: Rawhide Buttes, Larimer Co., Wyo. Employs 10 men. Mark E. Bennett, president; Edwin Hall, vice-president and general manager; W. M. Gager, secretary. Organized November 17, 1905, under laws of Wyoming, with capitalization $500,000, shares $1 par; issued, $206,400. Annual meeting, fourth Monday in November. Lands, 35 claims, area 700 acres, in the unorganized Rawhide Buttes district, also 100 acres of timber lands, showing country rocks of quartzite, schist and limestone, carrying 14 contact veins, of which 4, of 5′ average width, are opened by shafts of 30′ and 245′, showing malachite and azurite above, with sulphides in the lower workings, giving average assays of 8% copper, 4 oz. silver and $3

gold per ton. Mine has 810′ of workings, estimated to show 20,000 tons of ore. Equipment includes a 40-h. p. steam plant, with hoist and 4-drill air-compressor, and 4 mine buildings. Nearest railroad is the Chicago & Northwestern, 12 miles distant. Company plans continuous development, during 1906.

WYOMING MINING CO. **WYOMING.**

Mine office: Kirwin, Big Horn Co., Wyo. Titus Sheord, president; B. F. Brown, secretary; C. A. Tewksbury, superintendent. Ores carry copper, silver and gold values. Presumably idle.

WYOMING QUEEN MINING CO. **WYOMING.**

Office: Laramie, Wyo. Mine office: Jelm, Albany Co., Wyo. Louis Miller, president, treasurer and general manager; L. A. Hancock, secretary; preceding officers, C. F. Downing, E. E. Fairbrother, Ole Scar and John Wenzin, directors. Organized January, 1902, under laws of Wyoming, with capitalization $1,000,000, shares $1 par. Lands, 18 claims, area 360 acres, in the Jelm Mountains, 32 miles southwest of Laramie, the nearest railroad station, showing 3 fissure veins, carrying auriferous and argentiferous carbonates and sulphides, of good assay values, with a little native copper and galena. Development is by shafts of 70′, 70′ and 100′, on a gold vein, a shaft of 100′ on a vein carrying auriferous and argentiferous copper and lead sulphides, and a 250′ shaft on an auriferous copper vein, the mine also having tunnels of 70′ and 250′. Mine is wet, and needs pumps. Equipment includes a 6-h. p. gasoline hoist and several small buildings. Idle, at last accounts, through lack of funds.

WYONA IRON & COPPER CO. **WYOMING.**

Office: 928 Equitable Bldg., Denver, Colo. Mine office: Battle, Carbon Co., Wyo. Geo. E. Ross-Lewin, president; H. A. McIntrye, secretary and treasurer. Capitalization $2,000,000, shares $1 par. Lands, 16,380 acres, in 4 groups, in Wyoming, carrying iron and copper ores, coal, and indications of oil. Presumably idle.

COMPAÑIA MINERA YABRICOYA. **CHILE.**

Mine office: Iquique, Tarapacá, Chile. Property is the Aguada copper-silver mine, in the vicinity of Iquique.

YACO GROUP. **BRITISH COLUMBIA.**

Sundry idle claims, near Lynn Creek, Vancouver Island, British Columbia. Ore is chalcopyrite, associated with iron pyrites and pyrrhotite, assaying circa $4 gold per ton, with small silver values.

YADKIN CONSOLIDATED MINING CO. **NORTH CAROLINA.**

Organized 1903, under laws of North Carolina, with capitalization $1,000,000, to develop copper lands in that state. No trace of operations.

YADKIN MINING & IMPROVEMENT CO. **NORTH CAROLINA.**

Office: 508 Herman Bldg., Milwaukee, Wis. Lands are in Yadkin county, North Carolina. Presumably idle.

YADKIN & VIRGILINA COPPER & LAND CO. **NORTH CAROLINA.**

Organized 1903, under laws of North Carolina, with capitalization $750,000, to develop copper properties. No trace of operations.

YAEGER CAÑON COPPER CO. **ARIZONA.**

Office: Union Trust Bldg., Detroit, Mich. Mine office: Prescott, Yavapai Co., Ariz. Robert E. Plumb, president; Richard E. Sloan, vice-president and general manager; Geo. B. Russell, secretary; Geo. H. Russell, treasurer; C. E. Brinker, superintendent. Organized April 11, 1903, under laws of Arizona, with capitalization $800,000, shares $1 par. Lands, 21 claims, area 460 acres, in the Black Hills district. Formation is diorite and slate, showing three principal ore bodies, occurring as fissures in diorite, of which one, averaging 14′ width, is developed by shafts of 350′ and 900′, with about one half mile of underground openings, estimated to give 40,000 tons of ore in sight, with about 25,000 tons blocked out for stoping, ore being bornite and chalcopyrite, averaging 6% copper, 8 oz. silver and $2 gold per ton. Property has a 240-h. p. steam plant, with a 140-h. p. hoist, good for 3,500′ depth, and a 10-drill Sullivan air-compressor. A 60-ton concentrator, 30x104′, of wood and iron, has a No. 2 Austin centrifugal crusher, 2 trains of rolls and 5 Wilfley and Bartlett tables. Production, 1904, was 4,000 tons of ore, averaging 6.5% copper. Shipments were changed, 1906, to the Humboldt smelter. Management seems good and property is regarded as promising.

YALE GOLD-COPPER MINING CO. **BRITISH COLUMBIA.**

Presumably dead. Had lands, circa 1896, near Rossland, Yale district, British Columbia.

YAMATE MINE. **JAPAN.**

Mine office: Takigawa-mura, Kume-gori, Mimasaka, Japan. Is a very old property. Ore is slightly argentiferous chalcopyrite, associated with iron pyrites, galena and sphalerite, with arenaceous clay gangue, occurring in quartz-diorite. Best grade of ore yields 10% to 13% copper. Production, 1899, was 3,044 momme silver and 99,679 lbs. fine copper.

YAMPA MINE. **UTAH.**

Owned by Tintic Mining & Development Co.

YAMPA SMELTING CO. **UTAH.**

Office: 214 Dooly Bldg., Salt Lake City, Utah. Works office. Bingham Canyon, Salt Lake Co., Utah. Henry Stern, president; Geo. H. Robinson, general manager; James W. Neill, superintendent. Organized 1903, with capitalization $100,000, as a subsidiary corporation of the Tintic Mining & Development Co.

Property is a smelter, built 1904 and enlarged 1906. Buildings are of structural steel, and plant is modern in design and equipment. Smelter includes 2 blast-furnaces, 2 reverberatory furnaces and 6 calciners, having a daily capacity of circa 800 tons. The calciners, of 18′ outside diameter, have 6 superimposed hearths, each with its sets of rabbling arms and rakes. Owing to the great quantity of fines contained in the Yampa ores, considerable trouble has been experienced in smelting. A converter may be added shortly. Production of the works, 1905, was 4,069,886 lbs. fine copper, from Yampa ores.

YANCEY MINE. **NORTH CAROLINA.**

An old and idle mine, in Person county, North Carolina. Main vein

ranges 6′ to 14′ wide, showing tetrahedrite carrying 1 oz. to 7 oz. silver and circa $2 gold per ton.

YANKEE CONSOLIDATED MINING, MILLING & TUNNELING CO. COLORADO.

Mine office: Yankee, Clear Creek Co., Colo. Henry I. Seeman, manager, at last accounts. Lands include the Polaris, Lombard and other properties, carrying auriferous and argentiferous lead and copper ores. Has steam power and a 5-stamp mill.

YANKEE MINING CO. UTAH.

Mine office: Eureka, Juab Co., Utah. B. N. Lehman, superintendent. Ended 1905 with a cash balance of $68,322. Has argentiferous lead and copper ores, principal values being in lead and silver. Company is said to plan building a concentrator, to treat milling ore.

YAQUI CANYON COPPER CO. MEXICO.

Office: 408 Gumbel Bldg., Kansas City, Mo. Mine office: Suaqui de Batuc, Ures, Sonora, Mexico. Employs 10 to 15 men. A. J. Davies, president and general manager; S. M. Major, vice-president; Frank B. Foster, secretary and treasurer; T. W. Foster, superintendent; preceding officers, C. S. Bone and Wm. Herbert Collins, directors. Organized under laws of Arizona, with capitalization $2,000,000, shares $1 par; issued, $1,800,000. Annual meeting, second Tuesday in January.

Lands, 60 pertenencias, area 148 acres, with applications made for a 50-acre smelter-site and 5,000 acres of timber lands. Country rock is limestone, showing porphyry intrusions carrying 6 main contact veins, of which 2, under development, are estimated at 10′ average width, showing a variety of ores, giving average assays of 7% copper and 50 oz. silver from the copper veins, and 15% lead and 30 oz. silver, with a trace of gold, from the lead veins. Property is a antigua, supposed to be circa 300 years of age, showing considerable ore on the dumps, from ancient operations. It is planned to reopen the mine by a tunnel, to crosscut all known veins.

Management plans building a 10-ton reverberatory smelter, to treat the high grade oxidized ores, estimated by company to range from 10% to 25% copper and 100 oz. to 400 oz. silver per ton, with average value of circa $75 per ton. Property is some distance from a railroad, but the surveyed line for the extension of the Cananea, Rio Yaqui y Pacifico passes only 2 miles from the mine.

YAQUI COPPER CO. MEXICO.

Office: 170 Broadway, New York. Mexican general office: Hermosillo, Sonora, Mexico. Mine office: Sauqui de Batuc, Ures, Sonora, Mexico. Wm. Sauntry, president; John M. Thurston, vice-president and general counsel; Geo. E. Green, secretary and treasurer; Robt. B. Brown, general manager; Ed. Chamberlain, superintendent. Organized 1902, under laws of West Virginia, with capitalization $5,000,000, shares $1 par. Is said to have a floating debt.

Lands, originally were, or were claimed to be, 6,032 acres of mineral lands and 119,284 acres of timber and grazing lands, also water-rights to 25 miles

of the Yaqui river, mining lands being in the vicinity of Suaqui de Batuc, Campo Santo Niño, Sonora, Mexico, in the Sierra Madre Mountains, circa 120 miles from Hermosillo. Property is claimed to show antigua workings, iron ore and indications of coal. In June, 1906, the Montana de Cobre company was said to have acquired 1,000 pertenencias formerly held by the Yaqui Copper Co., hence present holdings are uncertain.

The Yaqui Co. apparently was a deliberate swindle, promoted solely for the purpose of selling stock, and the lying done by the original officers was of a monumental nature. The company claimed possession of the largest copper vein ever located, but has been unable to produce the same, for the inspection of visitors competent to judge of values. The writer was saved a long trip to this property, through the hostile Yaqui country, several years ago, by fortunately meeting, in Arizona, a miner, fresh from this property, who, in answer to an inquiry as to the force employed, replied "six miners and six typewriters."

The president of the company, Mr. Wm. Sauntry, is an experienced lumberman, and a fine judge of pine timber. The secretary and treasurer makes good time-recording machines, even if he did get mixed up with some scandals in the United States postal department. The superintendent is said to have managed a photograph gallery, with great success, for several years. One Gen. Henry I. Willie, a consulting engineer, who is still extant, was responsible for a good share of the prevarication done about this property.

YAQUI RIVER EXPLORATION CO. **MEXICO.**

Letter returned unclaimed from former office, Colorado Springs, Colo. Mine office: San Antonio de la Huerta, Sonora, Mexico.

YAQUI RIVER LAND & DEVELOPMENT CO., LTD. **MEXICO.**

Offices: 3, Bank Bldgs., Lothbury, London, E. C., Eng. T. Morriss, secretary. Organized Jan. 29, 1900, with capitalization £40,000, shares £1 par. Lands, 87,000 acres, near Guaymas, Sonora, Mexico. Idle.

YAQUI SMELTING & REFINING CO. **MEXICO.**

Works office: San Antonio de la Huerta, Sonora, Mexico. F. Davis, general manager; Geo. P. Hyde, superintendent, at last accounts. Property is a smelter, 80 miles east of Torres and 60 miles below Campo Santo Niño, circa 20 miles from nearest railroad. Plant, furnished by the Allis-Chalmers Co., is variously reported, at 125 tons to 250 tons nominal daily capacity, and includes a blast-furnace, specially designed to reconcentrate, smelt and refine ores of silver, lead and copper. In October, 1905, the company was considering changing over to a reverberatory smelter. Equipment includes a 2-story sampling mill, machine-shop, electric light plant and ice plant. The claim of the company, that it could not find a competent metallurgist to operate the plant, is a weak excuse, as there are many competent men to be had, and the trouble seems to be with the company, rather than with the plant. This is the first and only custom smelter in Sonora, and is surrounded by a rich mineral district, but adequate transportation facilities are utterly lacking, and the plant is operated under great difficulties, owing to depredations of the Yaqui Indians.

SOCIEDAD YAURICOCHA, LIMITADA. **PERÚ.**

Office and mine: Huaripampa, Yauyos, Perú. Was a small producer of argentiferous copper ores, at last accounts.

YAVAPAI COPPER CO. **ARIZONA.**

Office: 317 Main St., Springfield, Mass. Mine office: Prescott, Yavapai Co., Ariz. Geo. Nightingale, president; Frederick Carpenter, secretary. Organized, circa 1900, with capitalization $1,000,000, shares $10 par. Lands, 25 claims, area 500 acres, about midway between Prescott and Jerome. Idle for several years, deeply involved in debt, and practically moribund.

YAVAPAI DEVELOPMENT CO. **ARIZONA.**

Letter returned unclaimed from former office, Calumet, Mich. Mine office: care of E. A. Haggott, superintendent, Mayer, Yavapai Co., Ariz.

NEGOCIACION MINERA DE CLEMENTE YBARRA. **MEXICO.**

Mine office: Promontorios, Sonora, Mexico. Don Clemente Ybarra, owner; Jesús Maria Quijada, manager. Property includes the Almada y Terito, Alvarado and Gloria mines, carrying gold, silver and copper ores, developed by shafts and tunnels. Has 2 small smelters, Production, 1903, was 9,200 kgs. fine copper from La Valenciana smelter, and 8,000 kgs. copper from the Almada y Terito smelter. Employed circa 50 men, at last accounts.

YELTA MINE. **AUSTRALIA.**

Owned by Paramatta Copper Mines, Ltd.

YENISEI COPPER CO., LTD. **SIBERIA.**

Offices: 65, Gracechurch St., London, E. C., Eng. Mine office: Abakansk, Yenisei, Siberia. T. E. Hurst-Hodgson, chairman; J. D. Kendall, consulting engineer; E. L. Edmonds, mine manager; P. J. Brenchley, secretary. Organized Apr. 21, 1902, with capitalization £300,000, shares £1 par; issued, £182,007. Debentures, £5,869 outstanding. Lands include mineral leases of 8,500 acres, and timber rights over 470,000 acres, in the province of Yenisei, Siberia. Is opening two mines, which are said to average 5% copper, and contemplated erection of a smelting plant. The Julia mine is said to show reserves of 42,000 tons of 5% ore. Idle from lack of funds.

YORK HARBOUR COPPER CO., LTD. **NEWFOUNDLAND.**

Wound up, February, 1902. Lands sold to Humber Consolidated Mining & Manufacturing Co.

YORK HARBOUR MINE. **NEWFOUNDLAND.**

An idle property, at Birchy Cove, Bay of Islands, Newfoundland. Lands, 4 claims, area 6,400 acres, also 26,880 acres of timber lands, giving total holdings of 33,280 acres, on the west coast of Newfoundland. Country rocks are diorite, with 12 known fissure veins in serpentine, of which 5, including one of 50′ width, have been more or less developed, these showing cupriferous iron pyrites, claimed to carry 3% to 18% copper, occasional zinc, up to 50% sulphur, 0.5 oz. to 4 oz. silver and 40 cents to $1.40 gold per ton. Development is by shafts of 54′, 64′, 70′ and 400′, with circa 2,000′ of underground workings. Mine was discovered circa 1870, but active development was not begun until 1900. Equipment includes a 250-h. p. steam plant, with 5 hoists, an 8-drill Norwalk air-compressor, engine-house, boiler-house, sawmill and

wellings. Mine has a crusher, of 300 tons daily capacity, and a sub-
ial wharf, on a good harbor, connected with the mine by a 5,000′ ground-
, and is 14 miles distant from the Newfoundland railway. Was last
by Humber Consolidated Mining & Manufacturing Co. Presumably

EMITE COPPER MINING & REDUCTION CO. CALIFORNIA.

Office: 214 Potomac Bldg., Los Angeles, Cal. Mine office: Daulton,
ern Co., Cal. J. M. Hambelton, president; L. N. Richards secretary.
4 parallel veins, carrying auriferous and argentiferous copper ores, opened
n 80′ shaft. Has steam power. Presumably idle.

HIOKA MINE. JAPAN.

Owned by Mitsu Bishi Goshi-Kwaisha.

KA COPPER CO. BRITISH COLUMBIA.

Office: 515 Fidelity Bldg., Tacoma, Wash. Mine office: Yreka, Van-
ver Island, B. C. C. W. Riddell, president; C. D. Lynn, vice-president;
. Lewis, secretary and general manager; N. S. Clarke, general superin-
dent; W. C. Spicer, treasurer. Organized 1901, under laws of Washington,
capitalization $2,000,000, shares $1 par. Lands, 16 patented claims,
Comstock Mountain, Quatsino Sound, Vancouver Island, including the
stock and Superior groups, also 3 unpatented claims, in the Victoria dis-
, 2 miles from tidewater, on the eastern side of the island, this latter
up, known as the Yreka, being idle. The Superior group has an enormous
fact vein, claimed to show a 200′ outcrop, developed by 3 tunnels and an
n-cut, disclosing a large body of auriferous and argentiferous sulphide ore,
mated by company to carry average values of 7% copper, 2 oz. silver and
gold per ton. Amount of ore in sight is variously estimated at 2,000,000
4,000,000 tons, with perhaps 500,000 tons available for stoping, which un-
ubtedly is an over-estimate. The mine has a 10-drill air-compressor,
h direct-connected Pelton wheel. A 3,600′ Riblet aerial tram, of 600 tons
ly capacity, leads to a fine wharf having a 2,500-ton ore-bunker. There
o are two smaller aerial trams, of 400′ and 800′ length. The company
ntracted to ship 100,000 tons of ore to the Crofton smelter, on the strength
which contract the smelter people advanced considerable sums, and mined
out 2,500 tons, 1903-04. Management is considered honest and property
omising, but company's finances are in very unpromising condition, and
operty has been idle for several years.

TTEROEN MINE. NORWAY.

A Norwegian mine that shipped 1,300 tons of cupriferous pyrites in 1900.

UDA COPPER CO., LTD. AUSTRALIA.

Still-born. Company did not go to allotment.

YNDICAT DU YUNNAN, LTD. CHIN

Offices: 404, Salisbury House, London, E. C., Eng., and 32, Rue
e Grande, Paris, France. Achille Adam, president; G. T. Fro
London; G. de Maroussem, secretary in Paris; Consul-genera
ent in China. Organized Oct. 17, 1899, as the Anglo-Fore
ame changed, 1900, to present title, with capitalization £35

£1 ordinary shares and 2,500 deferred 1s. shares. Has a government concession, for 85 years, to exploit mineral deposits and incidentally built railways, canals, etc., in 7 districts of the province of Yunnan, China, on a royalty of 35% to the Chinese government, payable after deduction of 28% of net earnings for interest, sinking fund, and reserve. Inactive.

YUSPENSSKI MINE. **SIBERIA.**

Owned by Spassky Copper Mine, Ltd.

ZACATECAS & DURANGO MINING & SMELTING CO. **MEXICO.**

Letter returned unclaimed from former office, Los Angeles, Cal. Works office: Chalchihuites, Zacatecas, Mexico. Organized, 1905, to take over sundry independent plants, including a 60-ton concentrator and 40-ton smelter.

ZAMBESIA EXPLORING CO., LTD. **RHODESIA & PORTUGUESE EAST AFRICA.**

Offices: 30, Clements Lane, London, E. C., Eng. Tyndale White, chairman; Robert Williams, managing director; J. R. Farrell, consulting engineer; L. Scotland, secretary. Organized March 26, 1891, with capitalization, £40,000, increased, 1892, 1893, 1897, 1898, 1900, 1903 and 1905, to present figure of £450,000, shares £1 par; issued, £439,645. Lands, sundry mining claims, in Rhodesia, including copper claims in the Lomogunda district, 60,000 acres of farm lands, and extensive share interests in various South African and East African mining and industrial corporations.

COMPANHIA DA ZAMBEZIA. **PORTUGUESE EAST AFRICA.**

Offices: 53, Rua do Alecrim, 1a, Lisbon, Portugal and 10, Rue Lafayette, Paris, France. Organized May 20, 1892, under Portuguese royal decree, with capitalization 2,700 contos do reis, shares 4,500 reis (£1) par; issued, 2,025 contos do reis. Property is a concession of 60,000 square miles, on either side of the Zambesi and Shire rivers, extending east of latter to the coast, and embracing the ports of Quelimane and Chinde, Portuguese East Africa. Concession includes copper-bearing fields of prospective value.

ZAMBONA DEVELOPMENT CO. **MEXICO.**

Mine office: Minas Nuevas, Alamos, Sonora, Mexico. Has ores carrying native silver, silver sulphides and argentiferous chalcocite. Planned starting milling circa September, 1905.

MINAS ZAPATERO y OTRAS. **MEXICO.**

Office and mine: care of E. G. Kaufman, Ayutla, Jalisco, Mexico. Lands, 60 pertenencias, opened by a 100′ shaft and a 400′ tunnel, with 2,000′ of workings, showing 3 parallel veins of 5′ to 18′ average width, carrying ores assaying up to 10% copper, with gold and silver values. Erection of a reduction plant is under consideration.

COMPAÑIA MINERA ZAPOTECA. **MEXICO.**

Office: Laclede Bldg., St. Louis, Mo. Mine office: Ocotlán, Oaxaca, Mexico. Geo. T. Riddle, president; P. R. Flitcraft, secretary; Guillermo W. Thompson, general superintendent; F. J. Tayman, assistant superintendent. Organized January, 1903, under laws of West Virginia, with capitalization $1,000,000, shares $1 par. Lands, 33 pertenencias, area 81 acres, also 420

acres miscellaneous lands, in the Taviche district, including the Zapote mine, carrying auriferous copper and argentiferous lead ores, developed by a 400′ main shaft and 300′ tunnel. Has steam power, with a 30-h. p. Webster, Camp & Lane double-drum hoist, good for depth of 1,000′. Nearest railroad is the Ferrocaril Oaxaca y Ejutla, 8 miles distant.

ZARAGOZA COPPER & ZINC MINES, LTD. **SPAIN.**

Offices: 8, Union Ct., London, E. C., Eng. C. H. Crowther, secretary. Organized Nov. 14, 1900, (as Sarragoza Zinc Mines, Ltd., name changed to present title, January, 1901,) with capitalization £60,000, shares £1 par; issued, £9. Was formed to adopt an agreement with the Rio Tendio Copper Mines, Ltd., but agreement was not effected. Moribund.

COMPAÑIA MINERA ZAUCUDO. **COLOMBIA.**

Mine office: Medellin, Antioquia, Colombia. Juan de la Posado, superintendent. Operates the Zaucudo and Savalotas mines, producing gold, silver and copper. Has steam power and a smelter, employing several hundred men, at last accounts.

GEWERKSCHAFT DER ZECHE THALBURG. **GERMANY.**

Office: Düsseldorf, Germany. Mine office: Heiligenhaus, Rheinprovinz, Germany. Louis Zurhelle, president; H. Dressler, engineer. Has 2 shafts, developing sulphide ores of lead, zinc, copper and iron. Was working, in a very small way, at last accounts.

ZELLER ERZBERGWERKE G. m. b. H. **GERMANY.**

Mine office: Altlay bei Zell a/M., Rheinprovinz, Germany. R. Reiser, president. Produces cupriferous silver-lead ores, and employed circa 100 men, at last accounts.

ZELNORA MINE. **UTAH.**

Owned by Bingham-New Haven Copper & Gold Mining Co.

ZENITH GOLD & COPPER MINING CO. **WYOMING.**

Letter returned unclaimed from former mine office, Encampment, Carbon Co., Wyo. Organized, 1904, to develop claims on Purgatory Gulch, near lands of El Rey Gold & Copper Mining Co.

ZIMAPÁN MINING & SMELTING CO. **MEXICO.**

Office: 112 Fulton St., New York. Mine office: Zimapán, Hidalgo, Mexico. David Tim, trustee. Ended 1905 in financial straits, with claims exceeding $100,000 filed by creditors, against assets of $27,216. Is to be wound up.

ZOMEKI MINE. **JAPAN.**

Mine office: Ikuno-mura, Abu-gori, Nagato, Japan. Ores are slightly argentiferous chalcopyrite and bornite, associated with sphalerite, galena and pyrrhotite, occurring in lenses and fissure veins, near liparite dikes penetrating clay-slate, sandstone and limestone.

ZONIA COPPER MINING CO. **ARIZONA.**

Letter returned unclaimed from former office, 218 Tremont St., Boston, Mass., and from former mine office, Prescott, Yavapai Co., Arizona.

CHAPTER XXV.

General Copper Statistics.

This chapter, devoted to the statistics of the copper industry, contains a larger number of tables than in the earlier editions, and gives two or three times as much matter per page, it having been found possible to consolidate two and even three of the tables of the earlier editions into a single form. It will be found, in many cases, that a single table gives figures covering a half-dozen or more different but cognate points.

The exact order of precedence in which these tables are published is varied a trifle, from year to year, as required by mechanical exigencies. The task of "making-up" for the press upwards of forty different tables of statistics, each in somewhat different form from any other, and of greatly varying lengths, so as to appear in logical sequence, yet give full pages without awkward breaks or bad spacing, is one that can be appreciated only by an experienced printer, and the unusual degree of success that has been secured in the typographical handling of such extremely awkward matter also is to be fully appreciated only by those who have wrestled with similar problems. There is, however, a grouping of the statistics contained in this chapter, under nine sub-heads, which are given, in each edition, in the following invariable order, though there may be occasional transpositions of individual tables contained in a subdivision:

World's Production: Eight tables covering a variety of features.

American Production: Two tables.

Lake Superior Production: Two tables.

American Imports: One table.

American Exports: Two tables.

World's Copper Trade: Eleven tables covering imports, exports, supplies and consumption, for the world and for all leading consuming countries.

Prices and Values: Six tables.

Copper Share Finances: Eight tables, devoted to dividends, assessments, capitalization and sales of shares of American copper mining companies.

Future Production: One table, giving comparative figures by arithmetical progression, based upon the figures of production and consumption of the preceding century.

All tables are fully entered, both by titles and by numerous cross-references, in the index at the end of the volume.

WORLD'S COPPER PRODUCTION.

(*Long Tons.*)

Year.	United States.	Foreign.	Total.	Percentage of U. S. Production.
1880.....	27,000	126,959	153,959	17
1881.....	32,000	131,000	163,000	19
1882.....	40,467	141,155	181,622	22
1883.....	51,574	147,832	199,406	24
1884.....	64,708	155,141	220,249	29
1885.....	74,052	151,540	225,592	32
1886.....	70,430	146,656	217,086	32
1887.....	81,017	142,781	223,798	36
1888.....	101,054	156,972	258,026	39
1889.....	101,239	159,966	261,205	38
1890.....	115,966	153,489	269,455	43
1891.....	126,839	152,552	279,391	45
1892.....	154,018	156,454	310,472	49
1893.....	147,033	156,497	303,530	48
1894.....	158,120	166,385	324,505	49
1895.....	169,917	164,648	334,565	50
1896.....	205,384	167,979	373,363	54
1897.....	220,571	178,384	398,955	54
1898.....	235,050	194,106	429,156	54
1899.....	253,870	215,440	469,310	54
1900.....	269,111	216,743	485,854	57
1901.....	268,522	242,497	511,019	53
1902.....	294,297	247,870	542,167	54
1903.....	311,582	273,499	585,081	54
1904.....	362,739	278,955	641,694	56
1905.....	402,704	293,005	695,709	57
1906.....	409,414	303,200	712,614	57

COPPER PRODUCTION BY CONTINENTS.

(*Long Tons.*)

Year.	North America.	Europe.	South America.	Asia.	Australasia.	Africa.	Totals.
1896.....	222,524	88,948	26,340	21,000	11,272	7,450	377,534
1897.....	242,679	90,829	25,300	23,000	16,583	7,440	405,831
1898.....	261,625	89,461	30,065	25,175	15,943	7,110	429,379
1899.....	282,636	93,383	32,730	27,560	20,894	6,490	463,693
1900.....	303,784	91,009	36,095	28,121	21,270	6,720	486,999
1901.....	320,044	91,161	43,080	27,475	28,633	7,472	517,865
1902.....	355,280	91,552	40,266	29,775	27,281	4,450	548,604
1903.....	384,138	94,056	42,561	31,360	28,116	5,230	585,461
1904.....	445,557	90,820	41,265	34,850	26,657	7,775	648,924
1905.....	489,959	88,215	39,945	35,910	33,940	7,740	695,709
1906.....	497,794	91,995	36,855	42,740	36,250	6,980	712,614

WORLD'S COPPER PRODUCTION BY COUNTRIES.

(Based on the figures of Henry R. Merton & Co.)

(*Long Tons.*)

Country.	1890	1895	1900	1903	1904	1905	1906
Algeria	120	35	.....	.....	.....	415	440
Argentina	150	150	775	135	155	155	105
Australasia	7,500	10,000	23,000	29,468	34,160	33,940	36,250
Austria	1,210	1,110	865	1,055	1,275	1,175	1,225
Bolivia	1,900	2,250	2,100	2,000	2,000	2,000	2,500
Canada	3,050	4,000	8,500	19,321	19,185	20,535	25,460
Cape Colony	6,450	7,080	6,720	5,230	7,775	7,325	6,540
Chile	26,120	22,075	25,700	30,930	30,110	29,165	25,745
Great Britain	935	580	650	500	500	715	500
Germany	17,625	16,555	20,410	21,205	21,045	22,160	20,340
Hungary	300	200	490	330	175	150	210
Italy	2,200	2,500	2,955	3,100	3,335	2,950	2,865
Japan	15,000	18,430	27,840	31,360	34,850	35,910	42,740
Mexico	4,325	11,620	22,050	50,480	50,945	64,440	60,625
Newfoundland	1,735	1,800	1,900	2,710	2,200	2,280	2,295
Norway	1,390	2,685	3,935	5,915	5,415	6,305	6,120
Peru	150	450	8,220	7,800	6,755	8,625	8,505
Russia	4,800	5,280	8,000	10,320	10,700	8,700	10,490
Sweden	830	515	450	455	390	550	500
Spain & Portugal	51,700	54,950	52,872	49,740	47,035	44,810	49,320
United States	115,966	169,917	269,111	311,582	362,739	402,704	409,414
Turkey	.....	.....	520	1,400	950	700	425
Venezuela	5,640	.....	.....	.....	.....	.....	.....
Totals	269,096	332,182	486,363	585,081	641,694	695,709	712,614

ESTIMATE OF WORLD'S PRODUCTION FOR 1907.

This table, similar to estimates given in four preceding annual issues is merely an estimate, based upon the best data at command, of the probable output of copper by the world for the year 1907, compared with actual production of the two preceding years. As final figures are not obtainable until the latter half of each year, for the year preceding, the difficulties in the way of making a fairly accurate estimate of output for the current year, at the close of the year, are considerable, and in the case of the present estimate, the unprecedented condition of the metal market for the latter half of 1907, coupled with drastic restriction of output by many of the largest North American producers, introduces an element of doubt on every hand, rendering the work one of unusual delicacy. In view of these facts there may be a greater percentage of error than in previous estimates, which, when compared with final corrected figures, nearly a year later, proved to be 2.3% too high for 1902; 0.7% too low for 1903, 2.1% too low for 1904 and 3.7% too high for 1905:

(*Long Tons.*)

Country.	1905	1906	1907	Country.	1905	1906	1907
Algeria	415	440	450	Japan	35,910	42,740	44,000
Argentina	155	105	150	Mexico	64,440	60,625	56,500
Australasia	33,940	36,250	33,500	Newfoundland	2,280	2,295	2,200
Austria	1,175	1,225	1,250	Norway	6,305	6,120	6,250
Bolivia	2,000	2,500	2,250	Peru	8,625	8,505	11,000
Canada	20,535	25,460	20,000	Russia	8,700	10,490	12,000
Cape Colony	7,325	6,540	6,750	Sweden	550	500	500
Chile	29,165	25,745	28,500	Sp. & Portug.	44,810	49,320	48,000
Great Britain	715	500	500	United States	402,704	409,414	393,000
Germany	22,160	20,340	21,000	Turkey	700	425	750
Hungary	150	210	50				
Italy	2,950	2,865	3,000	Totals	695,709	712,614	691,600

WORLD'S PRODUCTION OF REFINED COPPER.

The following table, based upon figures of the Metallegesellschaft und Metallurgische Gesellschaft A.-G., gives estimated figures of production of raw copper of each country, whether from native or imported ores, matte or impure raw copper brought in for refining:

(*Metric Tons.*)

Country.	1895	1900	1902	1903	1904	1905	1906
United States.....	170,100	286,900	320,800	327,100	380,900	411,000	429,400
Great Britain.....	78,246	80,000	67,600	71,400	65,300	68,000	72,700
Mexico.....	7,000	10,000	30,300	42,200	48,500	53,300	51,000
Japan.....	15,500	24,300	29,000	33,200	32,100	33,700	45,000
Germany.....	25,777	30,900	30,600	31,200	30,300	31,700	32,300
Australia.....	12,100	21,800	20,000	19,500	22,700	23,900	29,500
Chile.....	19,600	20,000	21,000	22,000	22,000	21,000	20,000
Canada.....	100	500	300	7,200	8,000	10,700	13,800
Russia.....	5,854	8,100	8,800	10,500	10,900	8,900	10,600
Europe, misc.....	1,500	2,600	10,000	12,200	11,500	11,000	12,000
France.....	8,245	6,400	7,300	6,900	6,900	6,200	7,100
South America, misc.	3,800	4,000	4,000	4,000	4,000	4,000	4,000
Italy.....	2,375	2,800	3,900	3,600	3,600	3,600	3,600
Austria-Hungary....	1,276	1,200	1,300	1,400	1,500	1,400	1,500
Totals.....	351,473	499,500	554,900	592,400	648,200	688,400	732,500

WORLD'S PRODUCTION FOR THE NINETEENTH CENTURY.

(*Long Tons.*)

DECADE.	Average Price of Rough Copper.	World's Production of Each Decade.	Increase of Production over Previous Decades.	Average Annual Production for Each Decade.	Increase of Average Annual Production.
1801 to 1810	£160	91,000	.....	9,100	.....
1811 to 1820	130	96,000	5,000	9,600	500
1821 to 1830	101	135,000	39,000	13,500	3,900
1831 to 1840	94	218,400	83,400	21,840	8,340
1841 to 1850	83	291,000	72,600	29,100	7,260
1851 to 1860	111	506,999	215,999	50,699	21,599
1861 to 1870	87	900,000	393,001	90,000	39,300
1871 to 1880	79	1,189,000	289,000	118,900	28,900
1881 to 1890	60	2,373,398	1,084,398	237,339	108,439
1891 to 1900	52	3,708,901	1,335,503	370,890	133,550
Totals and Averages	96	9,507,299	.....	95,073	.....

PRODUCTION OF WORLD'S LARGEST MINES.

(*Pounds Avoirdupois.*)

Year.	Calumet & Hecla.	Anaconda.	Rio Tinto.	Boston & Montana.	Mansfeld.	Copper Queen.
1867...	1,315,173	.....	1,937,843	.....	5,865,898	.....
1868...	5,098,375	.....	2,475,765	.....	7,442,226	.....
1869...	12,315,771	.....	2,147,280	.....	8,084,140	.....
1870...	14,031,584	.....	2,231,055	.....	8,384,980	.....
1871...	16,222,590	.....	1,895,956	.....	8,718,480	.....
1872...	16,162,183	.....	1,772,498	.....	12,070,542	.....
1873...	18,848,265	.....	.....	.....	12,281,487	.....
1874...	20,125,225	.....	.....	.....	11,372,905	.....
1875...	21,473,954	.....	.....	.....	13,312,499	.....
1876...	21,690,732	.....	11,731,708	.....	13,852,024	.....
1877...	23,568,468	.....	41,057,139	.....	15,230,287	.....
1878...	25,253,128	.....	54,245,564	.....	17,645,115	.....
1879...	26,270,943	.....	50,228,595	.....	18,882,434	.....
1880...	31,675,239	.....	58,775,915	.....	21,734,902	1,379,940
1881...	31,360,781	.....	61,171,913	.....	24,377,210	3,866,581
1882...	32,053,528	.....	38,951,360	.....	25,795,840	7,744,278
1883...	33,125,045	.....	45,857,280	.....	28,310,320	7,523,981
1884...	40,473,585	.....	48,303,360	.....	28,183,680	7,668,617
1885...	47,247,990	36,000,000	52,604,160	7,500,000	27,888,000	6,663,782
1886...	50,518,220	33,267,864	55,328,000	2,000,000	28,212,800	3,797,256
1887...	46,016,123	57,000,000	63,840,000	1,500,000	29,176,000	5,707,728
1888...	50,295,721	63,245,473	63,840,000	18,278,667	29,970,200	12,031,614
1889...	48,668,296	61,647,000	66,080,000	25,425,228	34,733,440	12,152,910
1890...	59,868,106	64,046,812	67,200,000	25,942,298	35,392,000	13,120,934
1891...	63,586,620	46,500,000	71,680,000	25,000,000	30,920,000	13,022,957
1892...	56,495,211	75,000,000	70,560,000	30,386,595	34,406,400	12,916,416
1893...	60,427,913	75,256,657	69,664,000	31,800,000	31,696,000	13,795,618
1894...	61,324,626	95,578,000	73,920,000	50,000,000	33,677,600	12,968,372
1895...	79,137,399	99,775,294	75,040,000	55,000,000	33,286,400	16,235,723
1896...	89,280,621	125,350,693	73,920,000	60,250,000	40,913,600	22,966,169
1897...	83,248,054	131,471,127	75,936,000	60,000,000	40,230,400	23,999,873
1898...	86,426,320	107,214,059	75,499,200	62,000,000	40,420,800	33,747,390
1899...	89,610,963	107,914,357	76,988,800	65,000,000	46,558,400	36,901,684
1900...	77,761,382	110,000,000	80,039,680	66,200,000	41,193,600	34,382,309
1901...	82,519,676	101,850,224	79,179,520	70,000,000	41,067,200	39,781,333
1902 ..	81,248,739	100,000,000	77,235,200	75,000,000	41,000,000	35,831,735
1903...	76,490,869	93,500,000	80,214,400	90,750,000	42,500,278	36,385,000
1904...	80,341,019	90,000,000	80,214,400	94,000,000	41,629,349	58,605,000
1905...	95,100,610	95,000,000	72,307,200	89,000,000	43,824,141	64,570,847

PRODUCTION OF WORLD'S LEADING MINES.

In this table are given the latest products available of all the really important copper mines of the world, also the outputs of a great majority of the mines making as much as 50 short tons of copper yearly. Products given in round numbers are estimates, based upon the best information obtainable all other figures being exact returns.

(*Pounds Avoirdupois.*)

No.	Mine or Company.	Location.	Year.	Output.
1	Calumet & Hecla.....	Michigan, U. S. A...	1906	100,023,420
2	Anaconda.....	Montana, U. S. A...	"	95,997,440
3	Boston & Montana. ...	" " ...	"	93,461,344
4	American S. & R. Co...	U. S. A. & Mexico...	"	85,810,000
5	Copper Queen.....	Arizona, U. S. A....	"	79,536,416
6	Rio Tinto.....	Spain.....	1905	72,307,200
7	Greene Consolidated...	Mexico.....	"	64,211,895
8	Mansfeld.....	Germany.....	"	43,824,141
9	United Verde.....	Arizona, U. S. A....	1906	38,827,365
10	Calumet & Arizona....	" "	"	36,934,387
11	North Butte.....	Montana, U. S. A...	"	32,895,907
12	Copper Range.	Michigan, U. S. A...	"	32,382,983
13	Arizona.....	Arizona, U. S. A....	"	25,937,006
14	Furukawa.....	Japan.....	1905	23,780,573
15	Boléo.....	Mexico.....	"	22,817,610
16	Butte Coalition.	Montana, U. S. A...	1906	22,000,000
17	Mt. Lyell.....	Tasmania.....	"	19,293,120
18	Detroit.	Arizona, U. S. A....	"	19,112,188
19	Osceola.....	Michigan, U. S. A ..	"	18,588,451
20	Granby.....	British Columbia. . .	1905	17,843,390
21	Utah Consolidated.....	Utah, U. S. A.	"	17,264,474
22	Champion.....	Michigan, U. S. A...	1906	16,954,986
23	Old Dominion.....	Arizona, U. S. A....	"	16,602,186
24	Original.....	Montana, U. S. A...	"	16,500,000
25	Cape Copper Co.....	Cape Colony & Nfld.	1905	16,358,720
26	Quincy.....	Michigan, U. S. A...	1906	16,194,838
27	United States.....	Utah, U. S. A.	1905	15,841,667
28	Butte & Boston.....	Montana, U. S. A...	1906	15,783,000
29	Ashio.....	Japan.....	"	14,820,192
30	Kosaka.....	"	"	14,811,152
31	Baltic.....	Michigan, U. S. A...	"	14,397,557
32	Trenton.....	Montana, U. S. A...	"	13,398,400
33	Mitsu Bishi.....	Japan.....	1905	12,727,944
34	Tharsis.	Spain.....	"	12,590,226
35	Wallaroo & Moonta....	Australia.....	1904	12,250,000
36	Besshi.....	Japan.....	1906	11,973,833
37	Shannon.....	Arizona, U. S. A....	"	11,892,960
38	Bingham.....	Utah, U. S. A.	"	11,475,863
39	Tennessee.....	Tennessee, U. S. A..	"	11,319,591
40	Moctezuma.....	Mexico.....	1905	10,800,000
41	Mountain.	California, U. S. A. .	"	10,000,000
42	Washoe.....	Montana, U. S. A...	1906	10,000,000
43	Tamarack.....	Michigan, U. S. A ..	"	9,832,644
44	Wolverine.....	" " ..	"	9,681,706
45	Parrot.....	Montana, U. S. A...	"	9,650,000
46	Trimountain.....	Michigan, U. S. A ..	"	9,507,933
47	Mohawk.	" " ..	"	9,352,252
48	Superior & Pittsburg ..	Arizona, U. S. A....	"	9,044,875

PRODUCTION OF WORLD'S LEADING MINES. (Continued.)

(*Pounds Avoirdupois.*)

No.	Mine or Company.	Location.	Year.	Output.
157	Carmen	Chile	1905	1,300,000
158	Makimine	Japan	1906	1,275,097
159	Gulf Creek	Australia	1901	1,254,400
160	Mitterberg	Austria	1905	1,254,400
161	Aguascalientes	Mexico	"	1,250,000
162	Galizurski	Russia	"	1,250,000
163	P. Gonzalez	Chile	1904	1,250,000
164	Lake George	Australia	1901	1,250,000
165	White Knob	Idaho, U. S. A.	1904	1,250,000
166	Marble Bay	British Columbia	1905	1,200,000
167	Orito	Chile	1904	1,200,000
168	New England & Clifton	Arizona, U. S. A.	1906	1,140,770
169	Lambert	Chile	1903	1,175,000
170	De Soto	Arizona, U. S. A.	1906	1,128,327
171	Centre Star	British Columbia	1904	1,121,644
172	Gibson	Arizona, U. S. A.	1906	1,106,100
173	Snow Shoe	British Columbia	1904	1,100,000
174	Standard	Arizona U. S. A.	1905	1,088,952
175	J. K. Child & Co.	Bolivia	1904	1,075,200
176	Messina	Transvaal	1906	1,044,219
177	Anglo-Chilian	Chile	1904	1,000,000
178	Blinman	Australia	1905	1,000,000
179	Cabezas del Pasto	Spain	"	1,000,000
180	Crowl Creek	Australia	"	1,000,000
181	Maitenes	Chile	1902	1,000,000
182	Sotiel Coronada	Spain	1905	1,000,000
183	Mungana	Australia	1906	969,351
184	Hiragane	Japan	"	960,351
185	Iron Silver	Colorado, U. S. A.	1904	948,902
186	Arizona Commercial	Arizona, U. S. A.	1906	939,102
187	Blayney	Australia	1901	936,320
188	Yusenji	Japan	1906	921,491
189	Mond	Ontario	1901	917,600
190	Kusakura	Japan	1906	910,495
191	Huanchaca	Bolivia	1905	900,000
192	Llaillai	Chile	1903	900,000
193	Le Roi No. 2	British Columbia	1905	885,992
194	Puquios	Chile	1903	875,000
195	Torreón	Mexico	"	874,346
196	Las Herrerias	Spain	1905	857,920
197	Aljustrel	Portugal	1903	850,000
198	Guillermo Cavallo	Chile	1904	850,000
199	Niblack	Alaska, U. S. A.	1905	850,000
200	Daly-West	Utah, U. S. A.	1906	830,307
201	Equator	Arizona, U. S. A.	1905	800,000
202	Komaki	Japan	1904	800,000
203	Altens	Norway	1905	798,400
204	Bufa	Mexico	1906	750,000
205	Northern Territories	Australia	1905	750,000
206	Pitkaranta	Finland	1902	750,000
207	Furokura	Japan	1906	746,605
208	Twin Buttes	Arizona, U. S. A.	"	700,329
209	Hadley	Alaska, U. S. A.	1905	698,486

PRODUCTION OF WORLD'S LEADING MINES. (Continued.)

(*Pounds Avoirdupois.*)

No.	Mine or Company.	Location.	Year.	Output.
103	Michigan	Michigan, U. S. A.	1906	2,875,341
104	Santiago Vicuña	Chile	1903	2,875,000
105	Seville	Spain	1905	2,867,200
106	Osaruzawa	Japan	1906	2,817,152
107	La France	Montana, U. S. A.	"	2,750,000
108	Ramos	Mexico	1905	2,750,000
109	"Lloyd"	Australia	1906	2,739,520
110	Ani	Japan	"	2,680,588
111	Shattuck-Arizona	Arizona, U. S. A.	"	2,541,680
112	Copiapó	Chile	1905	2,515,520
113	Artola	"	"	2,500,000
114	Rudianski	Russia	"	2,500,000
115	Mt. Molloy	Australia	1906	2,441,846
116	Atacama	Chile	1905	2,396,252
117	Penn-Wyoming	Wyoming, U. S. A.	"	2,385,629
118	Coro Coro	Bolivia	1904	2,375,000
119	O. K.	Australia	1906	2,341,197
120	Saddle Mountain	Arizona, U. S. A.	"	2,338,492
121	Tiro General	Mexico	1905	2,281,761
122	Centennial	Michigan, U. S. A.	1906	2,253,015
123	Le Roi	British Columbia	1904	2,250,000
124	Queensland	Australia	1906	2,207,680
125	Hibira	Japan	"	2,166,102
126	Mass	Michigan, U. S. A.	"	2,106,739
127	Noel Berthin	Bolivia	1903	2,028,232
128	Alverdski	Russia	"	2,000,000
129	Girilambone	Australia	1905	2,000,000
130	Santa Ines y Morococha	Perú	"	2,000,000
131	Santa Rita	New Mexico, U.S.A.	"	2,000,000
132	Mt. Lyell Blocks	Tasmania	1906	1,846,320
133	Ikuno	Japan	"	1,845,091
134	Arakawa	"	"	1,802,215
135	Cervero	Chile	1902	1,792,000
136	Peña	Spain	1905	1,724,800
137	Live Oak	Arizona, U. S. A.	1906	1,714,074
138	Yoshioka	Japan	"	1,674,648
139	Besa i Ca	Chile	1903	1,644,573
140	Röros	Norway	1904	1,641,920
141	San Miguel	Spain	1905	1,612,800
142	Stadtberger	Germany	"	1,609,358
143	Adventure	Michigan, U. S. A.	1906	1,552,628
144	Atlantic	" "	"	1,539,082
145	Chillagoe	Australia	"	1,526,394
146	Ogoya	Japan	"	1,503,967
147	Castillo del Buitron	Spain	1905	1,500,000
148	Mitchell	Mexico	1906	1,500,000
149	Pánuco	"	1902	1,466,059
150	Obie	Japan	1906	1,455,488
151	Hisanichi	"	"	1,444,464
152	Indian Queen	Montana, U. S. A.	1903	1,400,000
153	Felix Vicuña	Chile	"	1,400,000
154	War Eagle	British Columbia	1905	1,400,000
155	Bede	Spain & Norway	"	1,370,880
156	Kune	Japan	1904	1,356,300

PRODUCTION OF WORLD'S LEADING MINES. (Continued.)

(*Pounds Avoirdupois.*)

No.	Mine or Company.	Location.	Year.	Output.
263	Las Vigas	Mexico	1903	300,000
264	Tip Top	Arizona, U. S. A.	1906	298,890
265	Winona	Michigan, U. S. A.	"	278,182
266	Esperanza	Mexico	1905	275,000
267	New Mt. Hope	Australia	1903	275,000
268	Phoenix	Michigan, U. S. A.	1905	273,219
269	American-Mexico	Mexico	1904	261,531
270	Bossmo	Norway	1902	250,000
271	Burra Burra	Australia	1904	250,000
272	Carisa	Utah, U. S. A.	1906	250,000
273	Lynda	Australia	1905	250,000
274	Rambler	Wyoming, U. S. A.	1903	249,196
275	Wissener	Germany	1902	240,742
276	Einasleigh Freehold	Australia	1901	232,960
277	Clemente Ham	Mexico	1902	231,830
278	Ate	Japan	1900	231,484
279	Quilomenco	Chile	1903	225,000
280	Mendoza y Ca	Mexico	"	218,874
281	Monterey S. & R. Co.	"	"	215,568
282	Kafveltorps	Sweden	1901	214,919
283	Eclipse-Argo	Montana, U. S. A.	1903	204,570
284	Cucharas	Mexico	"	200,618
285	Hamley	Australia	1905	200,000
286	Lower Mammoth	Utah, U. S. A.	1903	200,000
287	Francisco Vergara I.	Chile	"	200,000
288	Otori	Japan	1904	187,000
289	Coahuila	Mexico	1903	178,865
290	Capillitas	Argentina	1905	176,960
291	Boberthaler	Germany	1902	176,368
292	J. M. Echevarria	Chile	1903	175,000
293	Maximilian	Germany	1905	175,000
294	Merisski	Russia	"	175,000
295	Oregon S. & R. Co.	Oregon, U. S. A.	"	174,458
296	Castellanos y Ca	Chile	1904	160,000
297	Lake Superior & Arizona	Arizona, U. S. A.	1905	155,000
298	Shamblurgski	Russia	"	150,000
299	Mt. Cannindah	Australia	1906	139,776
300	Hogasho	Japan	1900	138,032
301	Eureka Hill	Utah, U. S. A.	1904	134,000
302	Pike Hill	Vermont, U. S. A.	1905	131,911
303	San Carlos	Mexico	1903	125,000
304	Los Ocotes	"	1904	121,000
305	Mozumi	Japan	1906	119,044
306	N. Azalia	Perú	1904	115,609
307	Culgoa	Australia	1906	114,240
308	Irigoyen Hnos. y Ca.	Mexico	1902	107,804
309	José R. Espinoza	Chile	"	100,000
310	Sucesion FranciscoGeisse	"	1903	100,000
311	La Dura	Mexico	"	100,000
312	Papovski	Siberia	1904	100,000
313	Quintera	Mexico	1902	100,000
314	Silver Spur	Australia	1905	100,000
315	Turgovski	Russia	"	100,000

AMERICAN COPPER PRODUCTION.

(*Long Tons.*)

Year.	United States Total Production	Michigan — Production	Michigan — Per cent of total	Montana — Production	Montana — Per cent of total	Arizona — Production	Arizona — Per cent of total
1850.....	650	572	88	.....	..	.....	..
1851.....	900	779	86	.....	..	.....	..
1852.....	1,100	792	72	.....	..	.....	..
1853.....	2,000	1,297	65	.....	..	.....	..
1854.....	2,250	1,819	81	.....	..	.....	..
1855.....	3,000	2,593	86	.....	..	.....	..
1856.....	4,000	3,666	91	.....	..	.....	..
1857.....	4,800	4,255	88	.....	..	.....	..
1858.....	5,500	4,088	74	.....	..	.....	..
1859.....	6,300	3,985	63	.....	..	.....	..
1860.....	7,200	5,388	74	.....	..	.....	..
1861.....	7,500	6,713	89	.....	..	.....	..
1862.....	9,000	6,065	67	.....	..	.....	..
1863.....	8,500	5,797	68	.....	..	.....	..
1864.....	8,000	5,576	69	.....	..	.....	..
1865.....	8,500	6,410	75	.....	..	.....	..
1866.....	8,900	6,138	69	.....	..	.....	..
1867.....	10,000	7,824	78	.....	..	.....	..
1868.....	11,600	9,346	80	.....	..	.....	..
1869.....	12,500	11,886	95	.....	..	.....	..
1870.....	12,600	10,992	87	.....	..	.....	..
1871.....	13,000	11,942	91	.....	..	.....	..
1872.....	12,500	10,961	87	.....	..	.....	..
1873.....	15,500	13,433	86	.....	..	.....	..
1874.....	17,500	15,327	87	.....	..	.....	..
1875.....	18,000	16,089	89	.....	..	.....	..
1876.....	19,000	17,085	89	.....	..	.....	..
1877.....	21,000	17,422	83	.....	..	.....	..
1878.....	21,500	17,719	82	.....	..	.....	..
1879.....	23,000	19,129	83	.....	..	.....	..
1880.....	27,000	22,204	82	.....	..	.....	..
1881.....	32,000	24,363	76	.....	..	.....	..
1882.....	40,467	25,439	62	.....	..	.....	..
1883.....	51,574	26,653	51	11,011	21	10,658	21
1884.....	64,708	30,961	47	19,256	30	11,935	18
1885.....	74,052	32,209	43	30,267	41	10,137	14
1886.....	70,430	36,124	51	25,362	36	6,990	10
1887.....	81,017	33,941	42	35,133	43	7,910	10
1888.....	101,054	38,604	38	43,704	43	14,195	14
1889.....	101,239	39,364	38	43,849	43	13,654	13
1890.....	115,966	45,273	39	50,437	43	15,534	13
1891.....	126,839	50,992	40	50,028	39	17,800	14
1892.....	154,018	54,999	36	72,860	47	17,160	11
1893.....	147,033	50,270	34	69,290	47	19,200	13
1894.....	158,120	51,031	32	81,729	52	19,873	13
1895.....	169,917	57,737	34	84,900	50	21,408	13
1896.....	205,384	63,418	31	99,071	48	32,560	16
1897.....	220,571	63,706	29	102,807	47	36,398	17
1898.....	235,050	66,056	28	92,041	39	49,624	21
1899.....	253,870	65,603	26	100,503	40	59,399	23
1900.....	269,111	63,461	24	120,565	45	52,820	20
1901.....	268,522	69,501	26	102,620	38	58,383	22
1902.....	294,297	76,050	26	128,975	44	53,546	18
1903.....	311,582	85,848	27	121,577	39	65,914	21
1904.....	362,739	93,001	26	133,176	38	85,179	23
1905.....	402,704	102,874	25	140,514	35	105,218	26
1906.....	469,111	102,222	25	131,563	32	117,216	

PRODUCTION OF WORLD'S LEADING MINES. (Continued.)

(*Pounds Avoirdupois.*)

No.	Mine or Company.	Location.	Year.	Output.
263	Las Vigas	Mexico	1903	300,000
264	Tip Top	Arizona, U. S. A.	1906	298,890
265	Winona	Michigan, U. S. A.	"	278,182
266	Esperanza	Mexico	1905	275,000
267	New Mt. Hope	Australia	1903	275,000
268	Phoenix	Michigan, U. S. A.	1905	273,219
269	American-Mexico	Mexico	1904	261,531
270	Bossmo	Norway	1902	250,000
271	Burra Burra	Australia	1904	250,000
272	Carisa	Utah, U. S. A.	1906	250,000
273	Lynda	Australia	1905	250,000
274	Rambler	Wyoming, U. S. A.	1903	249,196
275	Wissener	Germany	1902	240,742
276	Einasleigh Freehold	Australia	1901	232,960
277	Clemente Ham	Mexico	1902	231,830
278	Ate	Japan	1900	231,484
279	Quilomenco	Chile	1903	225,000
280	Mendoza y Ca	Mexico	"	218,874
281	Monterey S. & R. Co.	"	"	215,568
282	Kafveltorps	Sweden	1901	214,919
283	Eclipse-Argo	Montana, U. S. A.	1903	204,570
284	Cucharas	Mexico	"	200,618
285	Hamley	Australia	1905	200,000
286	Lower Mammoth	Utah, U. S. A.	1903	200,000
287	Francisco Vergara I.	Chile	"	200,000
288	Otori	Japan	1904	187,000
289	Coahuila	Mexico	1903	178,865
290	Capillitas	Argentina	1905	176,960
291	Boberthaler	Germany	1902	176,368
292	J. M. Echevarria	Chile	1903	175,000
293	Maximilian	Germany	1905	175,000
294	Merisski	Russia	"	175,000
295	Oregon S. & R. Co.	Oregon, U. S. A.	"	174,458
296	Castellanos y Ca	Chile	1904	160,000
297	Lake Superior & Arizona	Arizona, U. S. A.	1905	155,000
298	Shamblurgski	Russia	"	150,000
299	Mt. Cannindah	Australia	1906	139,776
300	Hogasho	Japan	1900	138,032
301	Eureka Hill	Utah, U. S. A.	1904	134,000
302	Pike Hill	Vermont, U. S. A.	1905	131,911
303	San Carlos	Mexico	1903	125,000
304	Los Ocotes	"	1904	121,000
305	Mozumi	Japan	1906	119,044
306	N. Azalia	Perú	1904	115,609
307	Culgoa	Australia	1906	114,240
308	Irigoyen Hnos. y Ca.	Mexico	1902	107,804
309	José R. Espinoza	Chile	"	100,000
310	Sucesion FranciscoGeisse	"	1903	100,000
311	La Dura	Mexico	"	100,000
312	Papovski	Siberia	1904	100,000
313	Quintera	Mexico	1902	100,000
314	Silver Spur	Australia	1905	100,000
315	Turgovski	Russia	"	100,000

AMERICAN COPPER PRODUCTION.

(*Long Tons.*)

Year.	United States Total Production	Michigan		Montana		Arizona	
		Production	Per cent of total	Production	Per cent of total	Production	Per cent of total
1850.....	650	572	88	.....	..	.....	..
1851.....	900	779	86	.....	..	.....	..
1852.....	1,100	792	72	.....	..	.....	..
1853.....	2,000	1,297	65	.....	..	.....	..
1854.....	2,250	1,819	81	.....	..	.....	..
1855.....	3,000	2,593	86	.....	..	.....	..
1856.....	4,000	3,666	91	.....	..	.....	..
1857.....	4,800	4,255	88	.....	..	.....	..
1858.....	5,500	4,088	74	.....	..	.....	..
1859.....	6,300	3,985	63	.....	..	.....	..
1860.....	7,200	5,388	74	.....	..	.....	..
1861.....	7,500	6,713	89	.....	..	.....	..
1862.....	9,000	6,065	67	.....	..	.....	..
1863.....	8,500	5,797	68	.....	..	.....	..
1864.....	8,000	5,576	69	.....	..	.....	..
1865.....	8,500	6,410	75	.....	..	.....	..
1866.....	8,900	6,138	69	.....	..	.....	..
1867.....	10,000	7,824	78	.....	..	.....	..
1868.....	11,600	9,346	80	.....	..	.....	..
1869.....	12,500	11,886	95	.....	..	.....	..
1870.....	12,600	10,992	87	.....	..	.....	..
1871.....	13,000	11,942	91	.....	..	.....	..
1872.....	12,500	10,961	87	.....	..	.....	..
1873.....	15,500	13,433	86	.....	..	.....	..
1874.....	17,500	15,327	87	.....	..	.....	..
1875.....	18,000	16,089	89	.....	..	.....	..
1876.....	19,000	17,085	89	.....	..	.....	..
1877.....	21,000	17,422	83	.....	..	.....	..
1878.....	21,500	17,719	82	.....	..	.....	..
1879.....	23,000	19,129	83	.....	..	.....	..
1880.....	27,000	22,204	82	.....	..	.....	..
1881.....	32,000	24,363	76	.....	..	.....	..
1882.....	40,467	25,439	62	.....	..	.....	..
1883.....	51,574	26,653	51	11,011	21	10,658	21
1884.....	64,708	30,961	47	19,256	30	11,935	18
1885.....	74,052	32,209	43	30,267	41	10,137	14
1886.....	70,430	36,124	51	25,362	36	6,990	10
1887.....	81,017	33,941	42	35,133	43	7,910	10
1888.....	101,054	38,604	38	43,704	43	14,195	14
1889.....	101,239	39,364	38	43,849	43	13,654	13
1890.....	115,966	45,273	39	50,437	43	15,534	13
1891.....	126,839	50,992	40	50,028	39	17,800	14
1892.....	154,018	54,999	36	72,860	47	17,160	11
1893.....	147,033	50,270	34	69,290	47	19,200	13
1894.....	158,120	51,031	32	81,729	52	19,873	13
1895.....	169,917	57,737	34	84,900	50	21,408	13
1896.....	205,384	63,418	31	99,071	48	32,560	16
1897.....	220,571	63,706	29	102,807	47	36,398	17
1898.....	235,050	66,056	28	92,041	39	49,624	21
1899.....	253,870	65,603	26	100,503	40	59,399	23
1900.....	269,111	63,461	24	120,865	45	52,820	20
1901.....	268,522	69,501	26	102,620	38	58,383	22
1902.....	294,297	76,050	26	128,975	44	53,546	18
1903.....	311,582	85,848	27	121,677	39	65,914	21
1904.....	362,739	93,001	26	133,176	38	85,179	23
1905.....	402,704	102,874	25	140,514	35	105,316	26
1906.....	409,414	102,222	25	131,563	32	117,216	29

UNITED STATES COPPER PRODUCTION BY STATES.

(Based on figures of the United States Geological Survey.)

(*Pounds Avoirdupois.*)

State.	1903.	1904.	1905.	1906.
Montana	272,555,854	298,314,804	314,750,582	294,701,252
Arizona	147,648,271	191,602,958	235,908,150	262,566,103
Michigan	192,299,191	208,355,935	230,437,992	228,976,937
Utah	38,302,602	47,062,889	58,153,393	50,329,119
California	17,776,756	28,529,023	16,697,489	28,153,202
Alaska	1,339,590	2,043,586	4,900,866	8,685,646
Idaho	778,906	2,158,858	7,321,585	8,578,046
Colorado	4,158,368	9,506,944	9,404,830	7,427,253
New Mexico	7,300,832	5,368,666	5,334,192	7,099,842
Nevada	150,000	.....	413,292	1,090,635
Washington	80,758	663,694	223,328	290,823
Wyoming	1,023,189	3,565,629	2,530,531	106,177
South Dakota	173,202	100,000	38	.....
Tennessee, East and South	13,855,612	15,211,086	15,134,960	17,809,442 620,829
Miscellaneous	500,000	120,118	846,615	647,583
Totals	697,943,131	812,563,954	902,057,843	917,086,889
From imported ores and matte	32,000,000	38,947,772	50,105,300	191,370,022
Grand Totals	729,943,131	851,511,726	952,163,143	1,108,456,911

LAKE SUPERIOR COPPER PRODUCTION BY MINES.

(*Pounds Avoirdupois.*)

Mines.	1903.	1904.	1905.	1906.
Calumet & Hecla	76,490,869	80,341,019	95,100,610	100,023,420
Osceola	16,059,636	20,472,429	18,938,965	18,588,451
Champion	10,564,147	12,212,954	15,707,426	16,954,986
Quincy	18,498,288	18,343,160	18,827,557	16,194,838
Baltic	10,580,997	12,177,729	14,384,684	14,397,557
Tamarack	15,286,093	14,961,885	15,824,008	9,832,644
Wolverine	9,024,034	9,764,455	9,464,418	9,681,706
Trimountain	9,237,051	10,211,230	10,476,462	9,507,933
Mohawk	6,284,327	8,149,515	9,387,614	9,352,252
Franklin	5,309,030	4,771,050	4,206,085	4,228,650
Allouez	.....	.....	1,167,957	3,486,900
Ahmeek	.....	376,687	1,552,957	3,077,507
Isle Royale	3,134,601	2,442,905	2,973,761	2,937,098
Michigan	275,708	2,746,127	2,891,796	2,875,341
Centennial	.....	641,294	1,446,584	2,253,015
Mass	2,576,447	2,182,931	2,007,950	2,106,739
Adventure	2,182,608	1,380,480	1,606,208	1,552,628
Atlantic	5,505,598	5,321,859	4,049,731	1,539,082
Winona	1,036,944	646,025	.....	278,182
Tecumseh	.....	.....	.....	58,008
Phoenix	202 823	1,162,201	273,219	.....
Miscellaneous	50,000	50,000	150,000	50,000
Totals	192,299,191	208,355,935	230,437,992	228,976,937

PRODUCTION, VALUE AND DIVIDENDS OF LAKE COPPER.

Year.	Gross Product fine copper (Pounds).	Gross value of production (Dollars).	Total Dividends paid (Dollars).	Percentage of dividends to gross values.	Dividends per pound of copper (Cents).
1845....	24,880	5,000	.....	....	.....
1846....	58,240	10,000	.....	....	.....
1847....	297,120	55,000	.....	....	.....
1848....	1,032,640	200,900	.....	....	.....
1849....	1,505,280	336,000	60,000	17.0	3.98
1850....	1,281,280	286,000	84,000	29.0	6.55
1851....	1,744,960	289,500	60,000	12.0	3.43
1852....	1,774,080	396,000	60,000	15.0	3.38
1853....	2,905,280	648,500	90,000	14.0	3.09
1854....	4,074,560	909,500	198,000	21.0	4.85
1855....	5,809,334	1,586,160	168,000	10.0	2.89
1856....	8,217,392	2,218,320	380,000	17.0	4.62
1857....	9,530,830	2,382,500	480,000	20.0	5.03
1858....	9,159,916	2,129,235	460,000	21.0	5.00
1859....	8,937,995	1,950,355	360,000	18.0	4.02
1860....	12,068,375	2,654,960	120,000	5.0	0.99
1861....	15,182,837	3,487,995	260,000	7.0	1.70
1862....	13,586,318	3,634,255	440,000	12.0	3.23
1863....	12,985,444	4,415,600	720,000	16.0	5.54
1864....	12,491,965	5,870,300	1,150,000	19.0	9.20
1865....	14,358,592	5,635,515	510,000	9.0	3.55
1866....	13,750,063	4,629,375	170,000	3.7	1.23
1867....	17,515,607	4,442,841	110,000	2.4	0.63
1868....	20,934,124	4,940,424	100,000	2.0	0.47
1869....	26,625,301	6,230,016	210,000	3.4	0.78
1870....	24,622,759	5,096,752	700,000	13.0	2.84
1871....	25,746,448	5,728,485	1,640,000	29.0	6.36
1872....	24,553,523	7,979,400	3,080,000	38.0	11.54
1873....	30,291,505	8,726,100	2,330,000	27.0	7.69
1874....	34,334,389	8,009,356	1,940,000	24.0	5.06
1875....	36,039,497	8,180,625	1,920,000	23.0	5.32
1876....	38,270,997	7,998,430	1,870,000	23.0	4.88
1877....	39,026,671	7,327,880	1,840,000	25.0	4.71
1878....	41,687,266	6,920,540	1,860,000	27.0	4.46
1879....	42,671,529	7,327,350	1,818,620	25.0	4.26
1880....	49,718,337	9,947,673	3,080,000	30.9	6.19
1881....	54,548,909	9,971,702	2,665,000	26.7	4.88
1882....	57,155,980	10,522,416	2,850,000	27.1	4.99
1883....	59,702,404	9,457,853	2,670,000	28.1	4.47
1884....	69,353,202	9,494,306	1,327,500	12.9	1.91
1885....	72,147,889	7,942,597	1,970,000	24.8	2.73
1886....	80,918,460	8,788,476	1,900,000	21.5	2.34
1887....	76,028,697	8,530,342	1,370,000	16.1	1.80
1888....	86,472,034	14,510,001	3,260,000	22.4	3.77
1889....	88,175,675	11,894,942	2,670,000	22.4	3.03
1890....	101,410,277	15,819,960	3,415,000	21.6	3.36
1891....	114,222,709	14,574,727	3,540,000	24.3	3.10
1892....	123,198,460	12,431,624	3,260,000	26.2	2.64
1893....	112,605,078	12,105,145	3,520,000	29.1	3.12
1894....	114,308,870	10,852,122	2,380,000	21.9	2.08
1895....	129,330,749	13,877,109	3,280,000	23.6	2.54
1896....	142,057,500	15,758,935	3,985,000	25.3	2.80
1897....	142,702,586	16,530,843	5,431,000	32.8	3.80

PRODUCTION, VALUE AND DIVIDENDS OF LAKE COPPER.—Cont'd.

Year.	Gross Product fine copper (Pounds.)	Gross value of production (Dollars.)	Total Dividends paid (Dollars.)	Percentage of dividends to gross values.	Dividends per pound of copper (Cents.)
1898.....	147,965,738	17,829 871	6,857,250	38.4	4.63
1899.....	146,950,338	26,098,382	12,318,450	47.2	8.39
1900.....	142,151,571	23,691,928	9,811,200	41.3	6.90
1901.....	155,716,848	26,038,857	7,496,900	28.8	4.81
1902.....	170,325,598	20,711,592	3,440,000	16.6	2.02
1903.....	192,299,191	26,383,449	4,980,000	18.8	2.59
1904.....	208,355,935	27,107,107	5,432,300	20.0	2.64
1905.....	230,437,992	36,616,586	9,224,600	25.2	4.02
1906.....	228,976,937	44,916,115	13,911,500	30.9	6.07
1907.....	232,000,000	50,409,280	13,469,950	26.7	5.80
Totals..	4,471,652,368	$645,242,218	$164,704,270	25.5	3.68

AMERICAN IMPORTS OF COPPER.

The following table showing imports of copper into the United States, in various forms, is summarized from the official figures of the United States government. The figures are somewhat unsatisfactory, for the reason that after and including 1895 the figures of ore are for gross weight of imported ore, while for preceding years the figures are for copper contents of the ore.

(*Pounds Avoirdupois.*)

Year.	Ore.	Matte.	Raw Copper.	Old Copper.	Estimated Total Fine Copper.
1890....	3,448,237	221,838	5,189	284,789	3,960,053
1891. . .	8,931,554	2,403,919	2,556	134,407	11,472,436
1892....	7,669,978	303,087	22,097	71,485	8,066,647
1893....	7,256,015	3,175,559	554,348	59,375	11,045,297
1894....	4,804,614	5,873,820	606,415	160,592	11,445,441
1895....	*a*8,921,920	*a*3,104,640	7,979,322	1,336,901	.....
1896....	*a*2,620,800	*a*3,427,200	9,074,379	2,422,554	.....
1897....	*a*43,919,680	2,974,720	12,646,552	1,780,390	28,923,098
1898....	*a*107,253,440	1,583,680	5,892,944	1,986,133	73,916,467
1899....	*a*120,934,616	7,763,885	64,282,583	6,678,145	95,722,340
1900....	*a*109,123,840	27,534,080	62,404,489	3,354,756	105,176,808
1901....	*a*131,790,400	75,913,600	71,001,713	2,818,757	137,826,406
1902....	*a*334,010,800	52,978,240	112,420,253	2,119,031	194,501,757
1903....	*a*607,407,360	30,461,760	133,472,398	3,235,597	168,707,995
1904....	*a*546,030,153	50,193,920	142,344,433	.....	181,292,205
1905....	*b*663,602,240	.....	156,358,243	4,561,142	210,724,685
1906....	.....	.....	176,558,390	.....	225,843,281

a. Gross weight of ore.

b. Gross weight of ore and matte combined.

AMERICAN COPPER EXPORTS.

The United States government estimates of exports of copper, including ingot and various forms of refined copper matte, blister copper and ores, and manufactured products, are as follows:

(*Pounds Avoirdupois.*)

Year Ending—	Ore and Matte.	Refined.	Value.
June 30, 1864.....	10,958,100	102,831	$ 432,570
1865.....	22,519,700	1,572,382	1,544,870
1866.....	21,508,000	123,444	936,211
1867.....	8,773,100	4,637,867	791,901
1868.....	9,261,200	1,350,896	922,409
1869.....	12,141,800	1,134,360	592,698
1870.....	1,919,800	2,214,658	1,042,246
1871.....	5,444,500	581,650	915,431
1872.....	3,556,400	267,868	287,735
1873.....	4,525,200	38,958	259,076
1874.....	1,332,600	503,160	467,208
1875.....	5,130,500	5,123,470	1,815,266
1876.....	1,530,400	14,304,160	3,526,410
1877.....	2,143,200	13,461,553	3,023,394
1878.....	3,294,700	11,297,876	2,488,921
1879.....	2,307,000	17,207,739	2,933,205
1880.....	2,162,300	4,206,258	849,218
1881.....	995,800	4,865,407	876,395
1882.....	2,593,600	3,340,531	748,456
1883.....	11,292,300	8,221,363	2,348,004
1884.....	38,614,000	17,044,760	5,595,859
1885.....	43,230,000	44,731,858	10,187,024
Dec. 31, 1886.....	41,752,000	19,553,421	4,380,322
1887.....	50,128,000	12,471,393	4,114,456
1888.....	79,496,000	31,706,527	11,897,240
1889.....	81,850,000	16,813,410	10,209,722
1890.....	43,141,100	10,971,899	5,918,395
1891.....	67,212,000	69,279,024	15,703,543
1892.....	94,304,000	30,515,736	10,162,870
1893.....	83,504,000	138,984,128	18,935,497
1894.....	8,704,000	162,393,000	16,143,094
1895.....	27,648,000	121,328,390	14,938,309
1896.....	41,426,500	259,223,924	31,035,211
1897.....	18,128,000	277,255,742	32,755,053
1898.....	18,686,000	291,955,905	35,545,251
1899.....	7,454,000	246,826,331	43,485,654
1900.....	20,014,000	337,973,751	58,875,439
1901.....	24,602,592	194,249,828	36,071,448
1902.....	40,398,400	354,668,849	46,811,729
1903.....	27,531,840	310,729,524	44,365,155
1904.....	42,396,480	554,550,030	74,816,934
1905.....	84,421,320	534,907,619	86,408,731
1906.....	106,666,560	454,752,018	.....

AMERICAN COPPER EXPORTS BY DESTINATIONS.

(*Pounds Avoirdupois.*)

Destination.	1900.	1904.	1905.	1906.
Holland	101,398,394	147,678,581	130,675,386	151,650,293
Germany	67,348,848	103,825,445	104,575,864	96,629,040
France	67,725,989	99,888,455	74,604,044	80,703,723
Great Britain	63,522,445	112,224,871	60,945,794	55,097,670
Italy	5,550,285	15,297,091	15,800,967	19,777,296
Russia	5,650,423	22,333,578	18,418,982	9,523,992
Belgium	12,554,191	9,365,791	4,997,206	6,475,054
China	.....	10,403,034	79,940,250	4,932,128
British North America	1,616,778	3,472,614	3,019,450	4,176,135
Mexico	296,684	191,429	290,763	263,319
Balance of Europe	11,258,115	29,064,494	25,279,162	25,260,807
Miscellaneous	1,051,599	804,647	16,359,751	262,561
Totals	337,973,751	554,350,030	534,907,619	454,752,018

AMERICAN COPPER EXPORTS BY PORTS.

(*Pounds Avoirdupois.*)

Ports.	1900.	1903.	1904.	1905.
New York	230,178,643	211,879,055	360,644,287	332,569,733
Baltimore	86,264,231	88,296,071	171,386,493	160,006,001
Puget Sound	.....	3,698	62,789	28,352,769
Newport News	2,016,000	1,969,177	7,626,951	6,002,955
Philadelphia	12,468,680	3,845,307	9,718,814	2,486,003
New Orleans	3,937,350	3,014	121,835	1,208,926
Detroit	469,819	611,327	1,187,706	1,032,541
Port Huron	149,525	261,820	532,841	597,712
Boston	1,496,387	512,053	838,321	383,811
Burlington, Vt	678,589	491,921	700,561	264,377
Norfolk	.....	1,771,993	560,536	.....
Miscellaneous	314,527	1,087,786	1,231,685	2,002,791
Totals	337,973,751	310,729,524	554,550,030	534,907,619

AMERICAN COPPER SUPPLY.

(*Pounds Avoirdupois.*)

Year.	Domestic Production.	Imports.	Total Supply.	Exports.	Net Supply.
1892	344,998,679	8,066,647	353,065,326	96,515,736	256,549,590
1893	329,354,398	11,045,297	340,399,695	188,984,128	151,415,567
1894	354,188,374	11,445,441	365,633,815	168,143,000	197,490,815
1895	380,613,404	14,616,223	395,229,627	136,528,390	258,701,237
1896	460,061,430	17,297,272	477,358,702	282,105,860	195,252,842
1897	494,078,274	28,578,420	522,656,694	288,662,340	233,994,354
1898	526,512,987	73,916,467	600,429,454	321,023,873	279,405,581
1899	568,666,921	95,722,340	664,389,261	252,876,480	411,512,781
1900	606,117,166	105,176,808	711,293,974	348,402,853	362,891,121
1901	602,072,519	137,826,406	739,898,925	222,137,911	517,761,014
1902	659,225,014	194,501,757	853,726,771	354,668,849	499,057,922
1903	729,943,131	168,707,995	898,651,126	310,729,524	587,921,602
1904	812,537,267	181,292,205	993,829,472	554,550,030	439,279,442
1905	902,057,843	210,724,685	1,112,782,528	534,907,619	577,874,909
1906	917,086,889	225,843,281	1 142,930,170	454,752,018	688,178,152

1907 — 880,320,000

AMERICAN COPPER TRADE.

This table, compiled from the figures of the Metallegesellschaft und Metallurgische Gesellschaft A.-G., of Frankfort-on-Main, is based upon official statistics of the United States, but gives all figures in round hundreds of tons: 1897-1906.

(*Metric Tons.*)

Year.	Production.	Imports.	Total Supply.	Gross Exports.	Net Supply.	Consumption
1897	224,100	12,200	236,300	130,900	105,400	117,400
1898	238,900	34,700	273,600	145,600	128,000	120,500
1899	258,000	46,500	304,500	114,600	189,900	169,000
1900	275,000	47,300	322,300	157,900	164,400	168,400
1901	273,000	80,100	353,100	100,800	252,300	189,800
1902	299,200	73,400	372,600	171,200	201,400	213,400
1903	316,600	75,900	392,500	145,400	247,100	236,100
1904	368,600	82,200	450,800	257,400	193,400	211,400
1905	395,300	95,700	491,000	250,300	240,700	276,300
1906	415,000	102,500	517,500	215,000	302,500	300,000

BRITISH AND FRENCH STOCKS OF COPPER.

This table, based on the compilations of Messrs. Henry R. Merton & Co., Ltd., of London, gives estimates of the stocks of refined copper on hand in Great Britain and France on the first day of each year named. The "visible supply" given in the last column includes also shipments afloat from Chile and Australia to European ports: 1888-1907.

(*Long Tons.*)

Year.	Public Stocks.	Increase.	Decrease.	Visible Supply.
1888	35,001	.....	.....	.....
1889	96,198	61,197	.....	104,105
1890	94,942	.....	1,256	98,847
1891	62,449	.....	32,493	65,366
1892	53,486	.....	8,963	56,044
1893	51,556	.....	1,930	55,745
1894	43,428	.....	8,128	47,295
1895	51,575	8,147	.....	54,664
1896	43,604	.....	7,971	45,817
1897	31,776	.....	11,828	34,927
1898	27,895	.....	3,881	31,955
1899	22,346	.....	5,549	27,896
1900	17,517	.....	4,829	22,817
1901	24,435	6,918	.....	28,860
1902	15,701	.....	8,734	22,051
1903	11,215	.....	4,486	16,540
1904	5,601	.....	5,614	13,851
1905	10,009	4,408	.....	16,734
1906	5,683	.....	4,326	12,983
1907	9,324	3,641	.....	16,924

ENGLISH COPPER TRADE.

(*Long Tons.*)

Year.	Production.	Imports.	Gross Supply.	Exports.	Net Supply.	Consumption
1880	3,662	92,734	96,396	59,482	36,914	.....
1881	3,875	86,227	90,102	61,689	28,413	.....
1882	3,464	93,875	97,339	55,683	41,656	.....
1883	2,620	99,146	101,766	59,350	42,416	.....
1884	3,350	109,390	112,740	64,691	48,049	.....
1885	2,733	123,549	126,282	62,080	64,202	.....
1886	1,471	108,015	109,486	60,511	48,975	.....
1887	389	103,089	103,478	69,453	34,025	.....
1888	1,456	135,470	136,926	72,066	64,860	3,667
1889	905	139,983	140,888	75,627	65,261	66,513
1890	935	141,249	142,184	89,747	52,437	84,930
1891	900	138,616	139,515	76,056	63,459	72,422
1892	495	134,371	134,866	82,542	52,324	54,254
1893	425	129,832	130,257	70,986	59,271	67,399
1894	445	125,008	125,453	54,689	70,764	62,617
1895	580	119,941	120,521	65,990	54,531	62,502
1896	580	135,856	136,436	59,334	57,102	61,370
1897	518	136,555	137,073	56,542	80,531	86,245
1898	640	139,704	140,344	63,256	77,088	81,312
1899	637	141,610	142,247	75,271	66,976	61,042
1900	765	154,941	155,706	56,997	98,709	105,586
1901	532	149,578	150,110	70,396	79,714	83,935
1902	482	160,201	160,683	69,156	91,527	97,639
1903	536	132,926	133,462	76,305	57,157	54,050
1904	493	157,897	158,390	73,447	84,943	88,039
1905	700	155,200	155,900	77,800	78,100	74,578
1906	700	145,400	146,100	66,300	79,800	76,159

FRENCH COPPER TRADE.

The following table is based upon the compilations of the Metallegesellschaft und Metallurgische Gesellschaft A.-G.:

(*Metric Tons.*)

Year.	Production.	Imports.	Gross Supply.	Exports.	Net Supply.	Consumption
1892	6,400	24,154	30,554	2,116	28,438	25,580
1893	6,600	26,060	32,660	2,204	30,456	28,596
1894	6,400	26,756	33,156	2,467	30,689	28,854
1895	8,245	32,656	40,901	3,163	37,738	32,388
1896	6,544	40,136	46,680	3,456	43,224	35,099
1897	7,400	48,028	55,428	3,559	51,868	43,100
1898	7,800	45,575	53,375	4,044	49,331	39,700
1899	6,600	49,515	56,115	6,882	49,233	42,600
1900	6,400	51,962	58,362	5,736	52,626	46,500
1901	7,000	41,196	48,196	5,122	43,074	34,300
1902	7,300	49,094	56,394	3,485	52,909	43,900
1903	6,900	46,834	53,734	4,658	49,076	42,700
1904	6,900	56,526	63,426	5,369	58,057	45,300
1905	6,200	56,500	62,700	6,600	56,100	50,200
1906	7,100	64,700	71,800	6,100	65,700	58,100

GERMAN COPPER TRADE.

The following table is based upon the compilations of the Metallegesellschaft und Metallurgische Gesellschaft A.-G.:

(*Metric Tons.*)

Year.	Production.	Imports.	Gross Supply.	Exports.	Net Supply.	Consumption
1884	18,113	13,819	31,932	6,906	25,026	25,000
1885	19,928	13,168	33,096	5,706	27,390	27,250
1886	19,314	11,913	31,227	6,510	24,717	25,000
1887	20,192	12,427	32,619	5,154	27,465	27,250
1888	21,017	8,082	29,099	4,530	24,569	24,500
1889	24,160	29,643	53,803	7,135	46,668	46,500
1890	24,427	31,408	55,835	8,428	47,407	47,000
1891	24,092	34,182	58,274	6,247	52,027	52,000
1892	24,781	32,498	57,279	6,598	50,681	50,000
1893	24,011	38,455	62,466	7,517	54,949	55,000
1894	25,722	37,032	62,754	6,609	56,145	56,000
1895	25,777	44,365	70,142	6,329	63,813	64,000
1896	29,319	56,814	86,133	5,996	80,137	80,000
1897	29,408	67,573	96,981	7,183	89,798	90,000
1898	30,695	73,291	103,986	6,972	97,014	97,000
1899	34,634	70,091	104,725	7,061	97,664	98,000
1900	30,929	83,503	114,432	5,505	108,927	107,000
1901	31,317	58,620	89,937	5,097	84,840	85,000
1902	30,578	76,050	106,628	4,678	101,950	100,000
1903	31,214	83,261	114,475	4,333	110,142	110,000
1904	30,264	110,231	140,495	4,223	136,272	135,000
1905	31,717	102,218	133,935	5,958	127,977	130,000
1906	32,275	126,066	158,341	7,243	151,098	150,000

AUSTRO-HUNGARIAN COPPER TRADE.

The following table is based on the figures of the Metallegesellschaft und Metallurgische Gesellschaft A.-G.:

(*Metric Tons.*)

Year.	Production.	Imports.	Gross Supply.	Exports.	Net Supply.	Consumption
1892	1,295	8,644	9,939	342	9,597	.....
1893	1,396	11,822	13,218	434	12,784	.....
1894	1,726	13,383	15,109	255	14,854	.....
1895	1,276	11,747	13,023	151	12,872	.....
1896	1,366	13,666	15,032	228	14,804	.....
1897	1,426	15,926	17,352	159	17,193	17,000
1898	1,343	17,442	18,785	173	18,612	18,300
1899	1,479	16,185	17,664	534	17,130	16,500
1900	1,200	18,970	20,170	471	19,699	18,700
1901	1,150	17,504	18,654	435	18,219	18,200
1902	1,350	18,256	19,606	436	19,170	19,200
1903	1,400	18,704	20,104	1,226	18,878	18,700
1904	1,463	22,532	23,995	747	23,248	23,100
1905	1,439	22,535	23,974	1,253	22,721	21,900
1906	1,457	24,488	25,945	1,271	24,674	24,200

RUSSIAN COPPER TRADE.

This table is based upon the compilations of the Metallegesellschaft und Metallurgische Gesellschaft A.-G.:

(*Metric Tons.*)

Year.	Production.	Imports.	Gross Supply.	Exports.	Net Supply.	Consumption
1892	4,978	6,568	11,546	.....	11,546	11,500
1893	5,100	8,756	13,856	.....	13,856	13,750
1894	5,409	6,666	12,075	.....	12,075	12,250
1895	5,854	8,100	13,954	.....	13,954	14,000
1896	5,832	12,433	18,265	.....	18,265	18,000
1897	6,941	12,507	19,448	.....	19,448	19,500
1898	7,291	14,450	21,741	.....	21,741	22,000
1899	7,533	11,100	18,633	.....	18,633	18,500
1900	8,100	12,300	20,400	.....	20,400	20,500
1901	8,100	10,900	19,000	.....	19,000	19,000
1902	8,800	17,500	26,300	.....	26,300	26,250
1903	10,500	14,450	24,950	.....	24,950	25,000
1904	10,900	20,300	31,200	.....	31,200	31,250
1905	8,900	18,700	27,600	.....	27,600	27,500
1906	10,600	16,000	26,600	.....	26,600	26,500

ITALIAN COPPER TRADE.

This table is based upon the compilations of the Metallegesellschaft und Metallurgische Gesellschaft A.-G.:

(*Metric Tons.*)

Year.	Production.	Imports.	Gross Supply.	Exports.	Net Supply.	Consumption.
1892	2,564	2,139	4,703	168	4,535	4,500
1893	2,371	3,043	5,414	157	5,257	5,250
1894	2,670	3,706	6,376	32	6,344	6,250
1895	2,375	4,350	6,725	84	6,641	6,750
1896	2,842	4,509	7,351	383	6,968	7,000
1897	2,980	5,032	8,012	222	7,790	7,750
1898	3,230	5,028	8,258	462	7,796	8,000
1899	3,032	5,006	8,038	1,355	6,683	6,500
1900	2,797	6,224	9,021	676	8,345	6,250
1901	3,483	5,982	9,465	100	9,365	9,500
1902	3,863	7,050	10,913	165	10,748	10,500
1903	3,620	6,096	9,716	162	9,554	9,750
1904	3,593	11,492	15,085	180	14,905	15,000
1905	3,578	13,795	17,373	170	17,203	17,250
1906	3,600	15,350	18,950	450	18,500	18,250

MISCELLANEOUS EUROPEAN COPPER TRADE.

This table is based upon the compilations of the Metallegesellschaft und Metallurgische Gesellschaft A.-G. It includes Sweden, Norway, Denmark, Holland, Belgium, the Balkan States and Spain and Portugal, but does not include copper production of the two latter named countries:

(*Metric Tons.*)

Year.	Production.	Imports.	Gross Supply.	Exports.	Net Supply.	Consumption.
1892	1,400	1,100	2,500	.....	2,500	2,500
1893	1,600	1,400	3,000	.....	3,000	3,000
1894	1,600	1,400	3,000	.....	3,000	3,000
1895	1,500	1,400	2,900	.....	2,900	2,900
1896	1,700	1,400	3,100	.....	3,100	3,100
1897	1,700	2,500	4,200	.....	4,200	4,200
1898	1,500	2,700	4,200	.....	4,200	4,200
1899	2,300	2,800	5,100	.....	5,100	5,000
1900	2,500	3,600	6,100	.....	6,100	6,000
1901	3,100	5,200	8,300	.....	8,300	8,500
1902	6,200	5,300	11,500	.....	11,500	11,250
1903	8,000	4,500	12,500	.....	11,900	12,000
1904	7,000	7,000	14,000	.....	14,200	14,000
1905	7,700	8,000	15,700	.....	15,000	15,000
1906	7,100	8,000	15,100	.....	15,400	15,500

WORLD'S CONSUMPTION OF RAW COPPER.

This table is based upon the compilations of the Metallegesellschaft und Metallurgische Gesellschaft A.-G.:

(*Metric Tons.*)

Country.	1895.	1900.	1902.	1903.	1904.	1905.	1906.
United States	118,835	168,400	213,400	236,100	211,400	276,300	300,000
Germany	63,813	108,900	102,000	110,100	136,200	128,000	151,100
Great Britain	91,551	108,500	120,000	107,600	127,900	103,300	107,600
France	38,174	51,600	53,400	48,600	56,600	56,400	65,500
Asia, Africa, Australia	8,000	10,200	17,200	17,600	38,800	73,000	28,000
Russia	14,000	20,400	26,300	25,000	31,200	27,600	26,600
Austria-Hungary	12,872	19,700	19,400	18,900	23,200	22,700	24,700
Italy	6,641	8,300	10,700	9,600	14,900	17,200	18,500
Belgium	5,000	6,300	6,700	6,100	7,800	8,600	9,000
Misc. Europe	1,800	2,100	2,400	3,400	4,000	4,000	4,000
Holland	2,400	2,400	2,400	2,400	2,400	2,400	2,400
Misc. America	700	1,300	2,000	1,700	2,400	1,900	2,200
Totals	363,786	508,100	575,900	587,100	656,800	721,400	739,600

AVERAGE AMERICAN AND ENGLISH PRICES.

The following table of average annual prices of copper in England and the United States is based upon the New York price for Lake copper and the London price for Standard copper. The last two columns give the American prices in cents and fractions and the English equivalent in sterling. English prices are for long tons of 2,240 pounds, and American prices for pounds avoirdupois, the last column, giving English equivalent of the American prices, being figured in long tons.

Year.	English Prices. Lowest.			Highest.			Fluctuation.			Average.			American Prices. Average Cents.	Average.		
	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.		£	s.	d.
1880	54	10	0	74	0	0	10	10	0	62	14	7	21 7/16	99	0	8
1881	57	0	0	72	10	0	15	10	0	61	16	9	18 3/16	84	0	8
1882	63	0	0	71	10	0	8	10	0	66	10	5	19 1/8	88	6	11
1883	57	0	0	67	10	0	9	10	0	62	17	11	16 1/2	76	3	7
1884	47	5	0	58	0	0	10	15	0	53	17	6	13	59	19	0
1885	38	10	0	61	12	6	23	2	6	43	11	0	10.67	49	6	5
1886	38	10	0	43	15	0	5	5	0	40	1	8	11 1/16	51	1	10
1887	38	7	6	85	5	0	46	17	6	46	0	6	13.85	64	0	0
1888	73	0	0	105	0	0	32	0	0	81	11	3	16.78	77	10	1
1889	35	0	0	80	0	0	45	0	0	49	14	8	13.49	62	6	5
1890	46	10	0	61	12	6	15	2	6	54	5	3	15.60	72	1	10
1891	44	1	3	56	10	0	12	8	9	51	9	4	12.76	58	19	1
1892	43	10	0	47	18	9	4	8	9	45	13	2	11.56	53	8	4
1893	40	12	6	46	16	3	6	3	9	43	15	6	10.75	49	13	10
1894	37	17	6	43	0	0	5	2	6	40	7	4	9.52	44	0	0
1895	38	13	9	47	8	9	8	15	0	42	19	7	10.73	49	12	0
1896	40	10	0	50	8	9	9	18	9	46	18	1	10.98	50	14	9
1897	47	0	0	51	15	0	4	15	0	49	2	6	11.36	52	10	2
1898	49	5	0	57	8	9	8	3	9	51	16	7	12.05	55	13	10
1899	58	1	3	79	2	6	21	1	3	73	13	9	17.76	82	0	11
1900	70	14	2	78	7	1	7	12	11	73	12	6	16.65	76	18	2
1901	47	0	0	72	17	6	25	17	6	66	19	8	16.72	77	4	7
1902	47	10	0	56	15	0	9	5	0	52	11	5	12.16	56	3	8
1903	53	13	7	64	0	7	10	7	0	58	3	2	13.72	63	4	8
1904	55	5	0	68	7	6	13	2	6	62	12	2	13.01	60	2	6
1905	64	2	6	80	12	6	16	10	0	69	9	2	15.89	73	7	9
1906	78	5	1	105	4	3	26	19	2	87	8	6	19.62	90	4	10
1907	55	0	0	113	0	0	58	0	0	84	0	0	20.00	91	19	10

PRICE OF ELECTROLYTIC COPPER.

The following table gives the average monthly prices of electrolytic wire-bars, on the New York Metal Exchange, for the years named:

(*Cents.*)

Month.	1900.	1903.	1904.	1905.	1906.	1907.
January	16.250	12.260	12.670	15.150	18.310	24.404
February	16.250	12.885	12.415	15.200	17.869	24.869
March	16.250	14.510	12.640	15.200	18.361	25.065
April	16.875	14.890	13.185	15.180	18.375	24.224
May	16.750	14.875	13.080	15.000	18.475	24.048
June	16.250	14.640	12.650	15.000	18.442	22.665
July	16.250	13.700	12.675	15.110	18.190	21.130
August	16.375	13.375	12.630	15.875	18.380	18.356
September	16.500	13.660	12.700	16.225	19.033	15.565
October	16.625	13.260	13.140	16.500	21.203	13.169
November	16.625	13.150	14.425	16.845	21.833	13.391
December	16.625	12.290	14.890	18.590	22.885	13.163

HIGH, LOW AND AVERAGE PRICES OF LAKE COPPER.

1860–1907.

(*Cents.*)

	Highest.		Lowest.		Average.
	Price.	Month.	Price.	Month.	
.....	24.000	January	19.750	December	22.875
.....	27.000	December	17.500	July	22.250
.....	32.875	November	20.750	May	21.875
.....	38.750	December	29.000	July	33.875
.....	55.000	July	39.000	January	47.000
.....	50.500	January	28.000	July	39.250
.....	42.000	January	26.500	November	34.250
.....	29.250	January	21.500	December	25.375
.....	24.500	December	21.500	January	23.000
.....	27.000	February	21.500	December	24.250
.....	23.375	November	19.000	March	21.188
.....	27.000	December	21.250	April	24.125
.....	44.000	April	27.125	January	35.563
.....	35.000	January	21.000	November	28.000
.....	25.000	January	19.000	August	22.000
.....	23.875	September	21.500	January	22.688
.....	23.250	January	18.750	August	21.000
.....	20.500	February	17.500	December	19.000
.....	17.625	January	15.500	October	16.563
.....	21.750	November	15.500	January	18.625
.....	25.000	January	17.875	June	21.438
.....	20.375	December	16.000	July	18.188
.....	20.375	January	17.875	April	19.125
.....	18.125	January	14.875	November	16.500
.....	15.000	December	11.000	December	13.000
.....	11.875	February	9.800	May	10.838
.....	12.125	December	10.000	May	11.063
.....	17.750	December	9.950	May	13.850
.....	17.600	November	15.850	January	16.775
.....	17.500	January	11.000	September	13.490
.....	17.250	July	14.000	March	15.600
.....	15.000	January	10.250	December	12.760
.....	12.375	December	10.500	February	11.560
.....	12.500	January	9.600	August	10.750
.....	10.250	January	9.000	June	9.520
.....	12.250	August	9.375	April	10.730
.....	12.000	June	9.750	January	10.980
.....	12.000	January	10.750	November	11.360
.....	13.250	December	11.000	January	12.050
.....	19.375	April	13.250	January	17.760
.....	17.250	April	16.000	February	16.650
.....	17.000	January	13.000	December	16.720
.....	13.500	February	11.000	January	12.160
.....	15.375	March	12.000	December	13.720
.....	15.375	November	12.250	February	13.010
.....	18.875	December	15.000	May	
.....	24.000	December	17.875	February	
.....	26.250	March	12.500	October	

MONTHLY PRICES OF LAKE SUPERIOR INGOT COPPER.

(*January-June.*)

Year.	January.		February.		March.		April.		May.		June.	
	Highest.	Lowest.	Highest.	Lowest.	Highest.	Lowest.	Highest.	Lowest.	Highest.	Lowest.	Highest.	Lowest.
1860	24	23½	24	23¾	23¾	23	23½	23	23¼	22¾	22½	21¾
1861	20	19	19½	19	19¼	19¼	19¾	19	19¾	19¼	19	18
1862	28	27	28	25	25	23	23	21½	21½	20¾	23	20¾
1863	35	31	37	35	37	31	31	30	30½	30	30½	30
1864	41¼	39	42	41¼	42½	41½	44	42½	44	43	49	44
1865	50½	46	46	44	44½	34	35	34	34	30	30½	28½
1866	42	38	38	35½	35½	29½	30	28½	31	29	33	31
1867	29¼	27	27¾	27½	27½	24	24½	23½	24¼	24	24½	24
1868	23½	21½	24	22½	24	23¼	24¼	23¼	24¼	24	24	23½
1869	26¼	23¾	27	26	26¾	24	24	23½	24¼	23¾	23¾	22
1870	22	21⅝	21¼	20⅞	20¾	19	19¾	19¼	19½	19	20⅝	19
1871	22⅞	22	22⅜	21⅞	22	21½	21¾	21¼	21¼	21⅜	21½	21¼
1872	28½	27⅛	28⅜	28¼	30½	28⅜	44	30½	42	36	34¼	33
1873	35	32½	35	34	35	34½	34½	30½	33½	32	31½	29⅛
1874	25	24½	25	24⅛	24⅜	24	25	24¼	25	24½	24¼	24¼
1875	23½	21½	22⅜	21¾	21¾	21½	21¾	21½	23¼	22⅝	23	23
1876	23¼	23	22¼	22½	22¼	22	22⅝	22	22⅛	21	21	19¾
1877	19½	19	20½	19½	19¼	19	19½	19¼	19½	19	19⅜	19
1878	17⅝	17¼	17½	17⅛	17⅛	16⅞	17	16⅞	16⅞	16¼	16⅜	16¼
1879	16	15½	15½	15½	15¼	15¼	16	15¼	16¼	16	16¼	16⅛
1880	25	21⅜	24½	24	24	22¾	22½	21	21	18	18½	17⅞
1881	19⅜	19⅜	19⅜	19⅛	19⅜	19	19	18¾	18⅞	18¼	18¼	16⅜
1882	20⅜	20¼	20	19	19¼	18⅞	18⅞	17¼	18¼	18	18¼	18
1883	18⅛	18	17⅞	17¾	17⅝	17⅛	16	15¼	16	15⅞	15⅞	15
1884	15	14⅞	15	14¼	15	14¼	15	14½	14½	14⅜	14¼	14
1885	11½	10⅜	11⅞	10⅝	11⅛	10⅜	11¼	10 1/10	11½	10⅛	11½	11
1886	11⅜	11⅜	11½	11⅜	11¼	11⅛	11¼	11⅜	11⅛	10	10⅛	10
1887	12	11⅛	11⅛	10⅛	10½	10⅜	10⅛	10	10	9 13/16	10¼	10
1888	17⅜	15 17/20	16 9/10	16	16 7/20	15 13/16	16 9/10	16	16⅜	16 3/10	16½	16 3/20
1889	17½	16½	16¼	16½	15¼	15	16	15½	12¼	12	12 1/16	12
1890	14½	14¼	14¼	14¼	14¼	14	14¼	14¼	15¼	14⅜	16¼	15¼
1891	15	14⅜	14¼	14¼	14¼	13⅜	13¾	13½	13¾	12¾	13	12¾
1892	11	10¾	10¾	10½	12	10¾	12	11¼	12¼	12	11⅞	11½
1893	12½	12¼	12¼	12	12	11¼	11½	11¼	11½	11	11	10¾
1894	10¼	10	10	9⅝	9⅝	9½	9¼	9⅛	9⅛	9¼	9¼	9
1895	10	9⅞	9⅞	9½	9¼	9¼	9¼	9⅛	10⅛	9¼	10½	10¼
1896	10⅛	9¾	11¼	10	11¼	10⅞	11	10¾	11½	10⅞	11¾	11½
1897	12	11½	12	11	11⅛	11½	11½	11	11⅛	10½	11⅛	10⅞
1898	11	10 9/10	11¾	11⅞	12	11⅝	12⅛	11⅞	12⅛	12	11⅝	11¾
1899	17	13¼	18½	17	18	17½	19⅜	18	19¼	18¼	18½	17¾
1900	16¼	16¼	16½	16	17	16¼	17¼	17	17¼	16½	16½	16¼
1901	17	17	17	17	17	17	17	17	17	17	17	17
1902	11	13	12¼	13½	12¼	12½	12	12½	12	12¾	12¼	12¾
1903	12¾	12¼	13½	12¾	15⅜	13½	15½	14⅜	15½	14¾	15½	14
1904	13	12½	12¾	12¼	13	12½	13⅜	13	13⅜	13	13⅜	12½
1905	15⅜	15½	15⅜	15⅜	15⅜	15⅜	15⅜	15½	15	15	15	15
1906	19	18½	18⅜	17½	18¼	18¼	18⅜	18¼	18¾	18¼	18⅞	18⅜
1907	25⅞	25	25⅞	25⅜	26¼	25¼	25¼	25¼	25¼	25⅛	24⅜	24⅜

MONTHLY PRICES OF LAKE SUPERIOR INGOT COPPER. (Continued.)
(*July-December.*)

Year.	July.		August.		September.		October.		November.		December	
	Highest.	Lowest.	Highest.	Lowest.	Highest.	Lowest.	Highest.	Lowest.	Highest.	Lowest.	Highest.	Lowest.
1860	21¾	21½	21½	21½	22	21¼	22	21½	21½	20¼	20¼	19¾
1861	18	17½	19	17¾	20¼	19	20¼	20	22½	20¼	27	22½
1862	24½	22½	24½	24	27	24¼	32⅞	27	32⅞	30½	31½	30½
1863	32	29	31	29	32½	31	34¼	32¼	38½	34½	38¾	38½
1864	55	49	52½	50	52½	47½	48	47	49	47	50	48½
1865	30¼	28	32	30½	32⅜	31½	33	32¼	45½	33	45½	39¼
1866	33½	31	31	30	31½	30¾	31	30¾	30¾	26½	29	26½
1867	26	24	26¼	25¾	27¼	26½	26¾	22¾	23	22⅜	23	21½
1868	24½	23⅛	24¼	24	24	23¾	24	23	24	22½	24½	23¼
1869	22¼	21⅞	23⅛	21⅞	23	22	22¾	22	22½	22	22	21½
1870	20½	20⅜	21⅜	20⅛	21½	20¾	21⅛	21½	23⅜	21¾	22⅜	22¼
1871	22¼	21⅝	23	22⅜	22⅞	22⅞	23⅞	23¼	24¼	23¼	27	24½
1872	34	33	35	32½	35¼	33	34¾	31¼	32¼	30¾	32½	30½
1873	29	26⅝	27½	27	27	25½	25½	24	24	21	25	23
1874	24¼	20	21	19	21¼	21	22¼	21¼	23¾	22¼	23¼	23¼
1875	23	22⅝	23⅜	23	23⅞	23⅛	23¼	23	23¼	23	23⅜	23⅜
1876	20	19½	19½	18¾	21	18¾	21¼	20½	20½	20	20	19⅝
1877	19¼	19	19	17⅞	18½	17⅞	18	17¾	17¾	17⅝	17¾	17½
1878	16¼	16	16	16	16¼	16	16	15½	15⅞	15½	16	15⅝
1879	16½	16	16⅜	16	17	16¼	21½	18	21¾	21	21½	21
1880	18⅞	18½	19¼	19	18⅞	18¾	18¾	18¾	18⅝	18¾	19½	18⅞
1881	16½	16	16⅝	16⅜	18⅛	16⅞	18⅜	18	19	18⅛	20⅜	19¼
1882	18¼	18⅛	18¼	18⅛	18¼	18	18¼	18	18⅛	18	18	17⅞
1883	15⅛	15	15	15	15¼	15⅛	15¼	15⅛	15	14⅞	15	14⅞
1884	14⅛	13⅞	14	13⅞	13¼	13	13⅛	12⅞	13	12½	12¼	11
1885	11¼	10⅞	11¼	11	11½	10 19/20	11⅛	10⅜	11⅛	10⅜	11½	11 1/10
1886	10⅛	10	10¼	10	11⅛	10¼	11⅜	11⅛	12	11⅜	12⅜	11⅛
1887	10¾	10⅛	10¾	10 9/16	11	10⅝	12 3/10	10 3/10	14 1/20	11 1/10	17¾	14 1/20
1888	16 9/10	16 1/20	17	16⅝	17 7/10	16 9/10	17⅝	17 7/10	17⅝	17¼	17 9/10	17 3/10
1889	12	12	12	12	12	11	11	11	13¼	11¼	14½	14
1890	17¼	16½	17¼	17	17	17	16⅞	16¾	16¾	16¾	16	15
1891	12⅞	12½	12⅜	12	12½	12⅛	12⅝	11⅜	11½	11	11⅛	10¼
1892	11¾	11¼	11¾	11⅜	11 3/10	11 1/10	11 3/10	11 1/10	12	11⅜	12⅜	12¼
1893	10½	10¼	10⅝	9⅜	9⅝	9¼	9¼	9¼	10¼	9¼	10⅞	10⅜
1894	9⅛	9	9⅛	9	9⅞	9⅛	9¾	9⅛	9½	9⅜	10	9½
1895	11⅜	10½	12¼	11¾	12¼	12	12	11⅞	11⅝	11	11	10
1896	11¾	11	11⅛	10⅞	10⅞	10⅜	10⅞	10½	11½	10⅞	11½	11¼
1897	11⅛	11	11¼	11	11⅜	11¼	11¼	11	11	10¼	11	10⅝
1898	11¾	11½	12⅛	11⅜	12¼	12⅛	11½	12¼	11¾	12½	12⅞	12⅝
1899	18½	18¼	18¾	18¼	18½	18⅜	18½	17	17¼	17	17	16¼
1900	16½	16⅛	16¾	16½	16⅞	16¾	16¾	16¾	17	16¾	17	16¾
1901	17	16¾	16¾	16¾	16¾	16¾	16 15/16	16¾	16 15/16	16 15/16	17	13
1902	12	12½	11⅝	12⅛	11⅞	12¼	11¾	12¼	11½	12	11⅝	12
1903	14¼	13	13¼	13	13¾	13¼	14	13	13¾	12¼	12⅜	12
1904	12⅞	12⅝	12⅞	12⅝	13	12¾	14	12⅞	15⅜	13⅞	15½	14⅞
1905	15⅜	15	16⅜	15½	16½	16½	16½	16½	17¾	16½	18⅛	17⅝
1906	18⅜	18½	18⅞	18¾	20⅛	18⅞	22½	20¼	22¾	22½	24	22¾
1907	24⅞	22¼	22¼	20	19¼	15¼	15¼	12½	14⅞	13½	14	13¼

CONVERSION TABLE FOR AMERICAN AND ENGLISH PRICES.

This table gives the equivalents, in American and English currency, for the prices of copper, from £35 to £150 per ton. The American basis of weight is the avoirdupois pound; the English basis is the long ton of 2,240 pounds avoirdupois. The rate of exchange is figured at £1=$4.85:

(*Pounds Sterling and Cents.*)

£35....7.58c.	£64....13.86c	£ 93....20.14c.	£122....26.41c.
£36....7.80c.	£65....14.07c.	£ 94....20.35c.	£123....27.63c.
£37....8.01c.	£66....14.29c.	£ 95....20.57c.	£124....27.85c.
£38....8.23c.	£67....14.51c.	£ 96....20.79c.	£125....27.06c.
£39....8.45c.	£68....14.72c.	£ 97....21.00c.	£126....27.28c.
£40....8.66c.	£69....14.94c.	£ 98....21.22c.	£127....27.50c.
£41....8.88c.	£70....15.16c.	£ 99....21.43c	£128....27.71c.
£42....9.10c.	£71....15.37c.	£100....21.65c.	£129....27.93c.
£43....9.31c.	£72....15.59c.	£101....21.87c.	£130....28.14c.
£44....9.53c.	£73....15.81c.	£102....22.08c.	£131....28.36c.
£45....9.75c.	£74....16.02c.	£103....22.30c.	£132....28.58c.
£46....9.96c.	£75....16.24c.	£104....22.52c.	£133....28.80c.
£47....10.18c.	£76....16.46c.	£105....22.73c.	£134....29.01c.
£48....10.39c.	£77....16.67c.	£106....22.95c.	£135....29.23c.
£49....10.61c.	£78....16.89c.	£107....23.16c.	£136....29.45c.
£50....10.83c.	£79....17.10c.	£108....23.38c.	£137....29.66c.
£51....11.04c.	£80....17.32c.	£109....23.60c.	£138....29.88c.
£52....11.26c.	£81....17.54c.	£110....23.82c.	£139....30.10c.
£53....11.48c.	£82....17.75c.	£111....24.03c.	£140....30.31c.
£54....11.69c.	£83....17.97c.	£112....24.25c.	£141....30.53c.
£55....11.91c.	£84....18.19c.	£113....24.47c.	£142....30.75c.
£56....12.12c	£85....18.40c.	£114....24.68c.	£143....30.96c.
£57....12.34c.	£86....18.62c.	£115....24.90c.	£144....31.18c.
£58....12.56c.	£87....18.84c.	£116....25.12c.	£145....31.39c.
£59....12.77c.	£88....19.05c.	£117....25.33c.	£146....31.61c.
£60....12.99c.	£89....19.27c.	£118....25.55c.	£147....33.83c
£61....13.21c.	£90....19.49c.	£119....25.77c.	£148....34.04c.
£62....13.42c.	£91....19.70c.	£120....25.98c.	£149....34.26c.
£63....13.64c.	£92....19.92c.	£121....26.20c.	£150....32.48c.

PROPORTION OF COPPER TO AMERICAN METAL PRODUCTION.

Year.	Total Value Metallic Products.	Total Value of Copper Production.	Production of Copper in Pounds.	Perc. of Cop. per Values.
1888.....	$253,731,822	$ 33,833,954	231,270,622	13.3
1889.....	267,247,033	26,907,809	231,246,214	10.0
1890.....	305,735,670	30,848,797	265,115,133	10.1
1891.....	300,232,798	38,455,300	295,812,076	12.1
1892.....	307,936,189	37,977,142	352,971,744	12.3
1893.....	250,207,406	32,054,601	339,785,972	12.8
1894.....	218,382,494	33,141,142	364,866,808	15.2
1895.....	282,149,808	38,682,347	392,639,964	13.8
1896.....	287,860,155	49,456,603	460,061,430	17.2
1897.....	302,531,147	54,080,180	494,078,274	17.9
1898.....	343,748,268	61,865,276	526,375,591	18.0
1899.....	525,797,557	101,222,712	581,319,091	19.0
1900.....	550,425,286	98,494,039	602,808,839	17.9
1901.....	524,873,284	86,629,266	601,499,886	16.5
1902.....	642,258,584	76,568,954	659,508,644	11.9
1903.....	624,318,008	91,506,006	698,044,517	15.3
1904.....	542,081,983	105,629,845	812,537,267	19.5
1905.....	702,453,101	139,795,716	902,057,843	19.9
1906.....	886,110,856	177,595,888	917,086,889	20.0

PRICES AND SALES OF AMERICAN COPPER SHARES.

Company.	1903. Highest.	1903. Lowest.	1903. Sales.	1904. Highest.	1904. Lowest.	1904. Sales.
Adventure.	$18.00	$ 2.00	50,070	$ 7.87	$ 1.75	55,094
Allouez.	7.50	3.13	152,262	21.00	3.37	258,301
Amalgamated.	79.50	35.50	1,717,341	82.75	43.13	.....
Anaconda	31.12	15.63	7,791	29.75	15.37	.....
Arcadian	6.13	.75	92,842	3.00	.25	30,208
Arnold.	.95	.25	4,582	1.50	.16	.....
Atlantic.	15.00	7.00	34,087	22.25	7.00	126,120
Bingham	39.00	20.00	126,200	38.75	19.00	257,516
Boston Cons	.....	.....	.....	7.87	6.12	126,859
British Columbia	7.50	2.50	2,018	3.75	3.25	.....
Calumet & Hecla.	550.00	400.00	5,371	700.00	435.00	4,395
Centennial.	31.75	12.00	301,086	33.00	14.63	202,483
Copper Range.	75.00	37.00	1,226,030	74.50	38.00	684,467
Daly-West.	48.56	30.50	46,749	36.50	11.63	106,904
Elm River.	5.38	2.00	67,078	4.00	1.75	.....
Franklin.	14.00	6.75	23,377	15.00	7.87	37,315
Granby.	5.25	3.63	53,639	5.88	3.00	436,287
Isle Royale	17.50	5.00	44,485	35.50	7.00	206,101
Mass.	18.00	3.00	65,717	10.00	3.00	59,746
Mayflower.	2.50	.50	15,634	2.00	.45	.....
Michigan.	11.50	4.50	29,087	11.00	4.25	48,159
Mohawk.	58.00	31.00	120,526	57.75	34.12	111,480
Montreal & Boston	2.88	.55	88,432	1.62	.40	.....
National.	1.25	.75	820	2.00	.40	.....
Old Colony	2.50	.50	20,106	2.50	.87	15,723
Old Dominion.	23.50	3.75	119,849	29.00	9.00	136,134
Osceola.	79.00	43.00	83,419	98.00	53.00	77,537
Parrot	34.00	16.00	59,512	33.50	21.00	72,217
Phœnix	7.50	2.75	23,522	5.00	.50	.....
Quincy.	126.50	80.00	6,438	125.00	80.00	10,023
Rhode Island	3.75	.75	15,815	3.00	1.00	11,594
Santa Fe	3.00	1.00	42,370	3.50	1.12	.....
Shannon.	15.00	7.00	133,571	10.50	6.50	555,011
Tamarack	189.50	75.00	15,239	140.00	94.00	10,236
Tecumseh	1.80	.40	7,505	4.25	.25	.....
Tennessee	33.00	17.25	11,030	43.25	30.00	.....
Trinity.	14.00	4.00	135,573	18.50	4.63	337,510
United Copper	32.75	4.00	6,520	7.00	6 00	.....
United States.	.....	.....	.....	28.75	19.75	633,140
Utah Cons.	33.63	22.00	400,247	47.00	30.00	1,553,158
Victoria	9.00	1.50	52,925	6.37	2.12	.....
Washington.	.50	.15	2,240	1.00	.10	.....
Winona	13.50	5.50	181,253	13.50	5.00	93,029
Wolverine	77.00	54.00	28,794	110.00	68.00	20,899
Wyandot	2.88	.75	54,552	3.00	.50	.....

DIVIDENDS OF AMERICAN COPPER MINES.

Company.	1905.	1906.	1907.	Total.
Anaconda	$ 2,400,000	$ 5,850,000	$ 7,500,000	$ 40,200,000
Arizona	917,230	1,496,150	1,994,865	11,657,840
Atlantic	50,000	.....	.....	990,000
Baltic	1,250,000	1,400,000	1,000,000	3,650,000
Bingham & NewHaven	.....	22,600	.....	22,600
Boston & Montana	4,500,000	7,200,000	5,750,000	55,975,000
Bullwhacker	.....	.....	20,000	20,000
Butte & Boston	.....	.....	.....	1,800,000
Butte Coalition	.....	800,000	1,650,000	2,450,000
Calumet & Arizona	1,700,000	2,600,000	3,300,000	9,300,000
Calumet & Hecla	5,000,000	7,000,000	6,500,000	105,850,000
Carisa	.....	25,000	.....	55,000
Centennial-Eureka	.....	.....	.....	2,767,700
Central	160,000	.....	.....	2,130,000
Champion	1,000,000	1,200,000	1,000,000	3,200,000
Cliff	.....	.....	.....	2,518,620
Columbus Cons	.....	.....	226,832	226,832
Colusa-Parrot	.....	.....	.....	1,760,000
Copper Falls	.....	.....	.....	100,000
Dalton & Lark	.....	.....	.....	350,000
Daly-West	218,000	432,000	378,000	5,957,000
Ducktown	169,653	328,900	328,900	1,202,500
Ferris-Haggarty	.....	.....	.....	15,000
Franklin	.....	.....	.....	1,240,000
Granby	399,991	1,620,000	1,217,430	3,371,051
Greene Cons	1,973,780	1,728,000	.....	7,450,580
Hadley Cons	15,000	.....	.....	15,000
Horn Silver	40,000	80,000	80,000	5,642,000
Iron Silver	400,000	300,000	300,000	4,100,000
Kearsarge	.....	.....	.....	160,000
Le Roi No. 2	90,000	240,000	210,000	900,000
Mammoth	.....	80,000	80,000	2,140,000
Minnesota	.....	.....	.....	1,820,000
Mohawk	.....	600,000	900,000	1,500,000
Montana O. P. Co.	324,000	808,330	1,212,495	9,437,274
Mountain	.....	.....	.....	3,776,250
National	.....	.....	.....	320,000
Newhouse	.....	.....	600,000	600,000
North Butte	500,000	2,900,000	2,400,000	5,800,000
Old Dominion	140,421	140,422	281,589	562,432
Osceola	384,600	961,500	1,249,950	7,035,650
Parrot	344,775	287,313	172,398	6,807,649
Pewabic	.....	.....	.....	1,000,000
Phoenix	.....	.....	.....	20,000
Quincy (Mich.)	600,000	1,250,000	1,350,000	18,170,000
Quincy (Utah)	.....	.....	.....	959,370
Red Bird	.....	.....	.....	72,000
Ridge	.....	.....	.....	100,000
Santa Rita	.....	.....	.....	100,000
Shannon	.....	150,000	300,000	450,000
Snow Storm	.....	.....	450,000	450,000
Standard	.....	.....	.....	40,000
Tamarack	120,000	480,000	420,000	9,600,000
Tennessee	.....	218,750	568,750	1,225,000
Trimountain	.....	.....	.....	300,000

DIVIDENDS OF AMERICAN COPPER MINES. (Continued.)

Company.	1905.	1906.	1907.	Total.
Tyee	.....	45,000	.....	180,000
United States	.....	1,252,708	3,598,730	4,851,438
United Globe	149,500	.....	.....	149,500
United Verde	2,025,000	2,700,000	2,700,000	24,405,680
Utah Cons	1,050,000	1,500,000	2,100,000	7,236,000
Wolverine	660,000	1,020,000	1,050,000	4,500,000
Totals	26,581,950	46,716,673	50,889,939	389,884,966
Amalgamated	6,933,000	10,716,153	10,716,153	54,177,433
Copper Range	1,536,086	2,302,686	2,302,686	6,525,239
United Copper	300,000	3,450,000	2,662,500	6,412,500
Grand Totals	35,351,036	63,185,512	66,571,278	457,000,138

TOTAL LAKE SUPERIOR DIVIDENDS.

Name of Company.	Present Status.	Dates Paid. First.	Dates Paid. Last.	Number of Dividends.	Total Amount.
Atlantic	*a*	1878	1905	19	990,000
Baltic	*b*	1905	1907	7	3,650,000
Calumet	*c*	1870	1871	3	300,000
Calumet & Hecla	*b*	1871	1907	140	104,900,000
Central	*c*	1864	1905	31	2,130,000
Champion	*b*	1903	1907	47	4,700,000
Cliff	*d*	1849	1867	37	2,518,620
Copper Falls	*a*	1864	1871	3	100,000
Franklin	*b*	1863	1894	21	1,240,000
Hecla	*c*	1869	1871	7	650,000
Kearsarge	*e*	1890	1897	3	160,000
Minnesota	*f*	1854	1876	19	1,820,000
Mohawk	*b*	1906	1907	4	1,500,000
National	*a*	1861	1872	9	320,000
Osceola	*b*	1878	1907	60	7,420,250
Pewabic	*g*	1862	1873	11	1,000,000
Phœnix	*a*	1877	1877	1	20,000
Quincy	*b*	1862	1907	82	17,170,000
Ridge	*h*	1873	1880	4	100,000
Tamarack	*b*	1888	1907	43	9,600,000
Trimountain	*b*	1903	1903	2	300,000
Wolverine	*b*	1898	1907	19	4,500,000
Totals				572	165,088,870
Copper Range Cons.	*i*	1905	1907	11	6,136,214
Copper Range Co.	*i*	1905	1907	9	1,350,000
St Mary's M. L. Co.	*i*	1886	1907	29	3,480,000
Grand Totals				621	176,055,084

a. Idle.
b. Active.
c. Absorbed by Calumet & Hecla.
d. Absorbed by Tamarack.
e. Absorbed by Osceola.
f. Absorbed by Michigan.
g. Absorbed by Quincy.
h. Absorbed by Mass.
i. Not a direct copper producer.

DIVIDENDS OF LAKE SUPERIOR MINES.

1849-1872.

	1849.	1850.	1851.	1852.
Cliff	$ 60,000	$ 84,000	$ 60,000	$ 60,000
Totals	$ 60,000	$ 84,000	$ 60,000	$ 60,000

	1853.	1854.	1855.	1856.
Cliff	$ 90,000	$ 108,000	$ 78,000	$ 180,000
Minnesota	.....	90,000	90,000	200,000
Totals	$ 90,000	$ 198,000	$ 168,000	$ 380,000

	1857.	1858.	1859.	1860.
Cliff	$ 180,000	$ 160,000	$ 180,000	$ .....
Minnesota	300,000	300,000	180,000	120,000
Totals	$ 480,000	$ 460,000	$ 360,000	$ 120,000

	1861.	1862.	1863.	1864.
Cliff	$ 80,000	$ 80,000	$ 180,000	$ 320,000
Minnesota	100,000	160,000	160,000	60,000
National	80,000	80,000	.....	80,000
Pewabic	.....	60,000	120,000	200,000
Quincy	.....	60,000	200,000	280,000
Franklin	.....	.....	60,000	100,000
Central	.....	.....	.....	50,000
Copper Falls	.....	.....	.....	60,000
Totals	$ 260,000	$ 440,000	$ 720,000	$1,150,000

	1865.	1866.	1867.	1868.
Cliff	$ 200,000	$ 120,000	$ 60,000	$ .....
National	40,000	.....	.....	.....
Quincy	160,000	.....	.....	60,000
Franklin	60,000	.....	.....	.....
Central	50,000	50,000	50,000	40,000
Totals	$ 510,000	$ 170,000	$ 110,000	$ 100,000

	1869.	1870.	1871.	1872.
Cliff	$	$	$ 100,000	$ 100,000
Minnesota	.....	.....	.....	50,000
National	.....	.....	20,000	20,000
Pewabic	.....	.....	20,000	40,000
Quincy	40,000	120,000	140,000	350,000
Franklin	.....	.....	20,000	40,000
Central	70,000	80,000	50,000	80,000
Copper Falls	.....	.....	40,000	.....
Hecla	100,000	300,000	250,000	.....
Calumet	.....	200,000	100,000	.....
Calumet & Hecla	.....	.....	900,000	2,400,000
Totals	$ 210,000	$ 700,000	$1,640,000	$3,080,000

DIVIDENDS OF LAKE SUPERIOR MINES. (Continued.)

1873-1888.

	1873.	1874.	1875.	1876.
Minnesota	$	$	$	$ 10,000
Pewabic	20,000	.....	.....	.....
Quincy	100,000	160,000	220,000	160,000
Central	160,000	160,000	80,000	100,000
Calumet & Hecla	2,000,000	1,600,000	1,600,000	1,600,000
Ridge	50,000	20,000	20,000	.....
Totals	$2,330,000	$1,940,000	$1,920,000	$1,870,000

	1877.	1878.	1879.	1880.
Cliff	$	$	$ 38,620	$ .....
Quincy	80,000	100,000	40,000	220,000
Central	140,000	100,000	80,000	100,000
Calumet & Hecla	1,600,000	1,600,000	1,600,000	2,500,000
Ridge	.....	.....	.....	10,000
Phœnix	20,000	.....	.....	.....
Atlantic	.....	20,000	.....	40,000
Osceola	.....	40,000	60,000	210,000
Totals	$1,840,000	$1,860,000	$1,818,620	$3,080,000

	1881.	1882.	1883.	1884.
Quincy	$ 320,000	$ 520,000	$ 380,000	$ 280,000
Franklin	.....	.....	.....	80,000
Central	120,000	50,000	60,000	40,000
Calumet & Hecla	2,000,000	2,000,000	2,000,000	800,000
Atlantic	.....	80,000	80,000	40,000
Osceola	225,000	200,000	150,000	87,500
Totals	$2,665,000	$2,850,000	$2,670,000	$1,327,500

	1885.	1886.	1887.	1888.
Quincy	$ 180,000	$ 240,000	$ 200,000	$ 360,000
Franklin	40,000	80,000	40,000	120,000
Central	30,000	40,000	40,000	70,000
Calumet & Hecla	1,700,000	1,500,000	1,000,000	2,000,000
Atlantic	20,000	40,000	40,000	120,000
Osceola	.....	.....	50,000	150,000
Tamarack	.....	.....	.....	440,000
Totals	$1,970,000	$1,900,000	$1,370,000	$3,260,000

DIVIDENDS AND ASSESSMENTS OF LAKE SUPERIOR MINES. (Continued.)

Company.	Assessments.	Dividends.	Dr. Balance.	Cr. Balance.
Delaware	2,000,000	.....	2,000,000	.....
Elm River	1,200,000	.....	1,200,000	.....
Evergreen Bluff	225,000	.....	225,000	.....
Flint Steel	264,000	.....	264,000	.....
Forest	180,000	.....	180,000	.....
Franklin	220,000	1,240,000	.....	1,020,000
Humboldt	120,000	.....	120,000	.....
Huron	240,000	.....	240,000	.....
Indiana	200,000	.....	200,000	.....
Isle Royale	2,000,000	.....	2,000,000	.....
Kearsarge	180,000	160,000	20,000	.....
Mass Cons	1,900,000	.....	1,900,000	.....
Mayflower	800,000	.....	800,000	.....
Michigan	1,600,000	.....	1,600,000	.....
Miners	2,000,000	.....	2,000,000	.....
Minnesota	456,000	1,820,000	.....	1,364,000
Mohawk	2,100,000	1,500,000	600,000	.....
National	320,000	320,000	.....	.....
Nonesuch	400,000	.....	400,000	.....
Northwest	283,000	.....	283,000	.....
Norwich	230,000	.....	230,000	.....
Ohio Trap Rock	150,000	.....	150,000	.....
Old Colony	1,100,000	.....	1,100,000	.....
Osceola	1,700,000	7,420,250	.....	5,720,250
Pennsylvania	126,000	.....	126,000	.....
Peninsula	400,000	.....	400,000	.....
Pewabic	585,200	1,000,000	.....	414,800
Phœnix (Old)	1,037,500	20,000	1,017,500	.....
Phœnix Cons	1,350,000	.....	1,350,000	.....
Quincy	200,000	17,170,000	.....	16,970,000
Ridge	470,000	100,000	370,000	.....
Rhode Island	1,000,000	.....	1,000,000	.....
Tamarack	320,000	9,600,000	.....	9,280,000
Tamarack Junior	640,000	.....	640,000	.....
Tecumseh	500,000	.....	500,000	.....
Trimountain	1,900 000	300,000	1,600,000	.....
Toltec	500,000	.....	500,000	.....
Victoria	1,100,000	.....	1 100,000	.....
Winona	1,600,000	.....	1,600,000	.....
Wolverine	230,000	4,500,000	.....	4,270,000
Wyandot	850,000	.....	850,000	.....
Miscellaneous	10,000,000	.....	10,000.000	.....
Totals	$66,507,700	$171.225,084	$51,305,500	$156,022,884
Credit Balance	.....	.....	.....	104,717,384

ASSESSMENTS OF LAKE SUPERIOR MINES.

Company.	1897.	1898.	1899.	1900.
Adventure	$.....	$.....	$.....	$200,000
Allouez	.....	80,000	.....	.....
Arnold	.....	180,000	180,000	.....
Baltic	100,000	100,000	300,000	.....
Centennial	120,000	270,000	.....	270,000
Copper Range	.....	.....	.....	300,000
Humboldt	20,000	.....	.....	.....
Mass	.....	.....	.....	200,000
Mohawk	.....	.....	.....	250,000
National	.....	200,000	.....	.....
Tecumseh	40,000	.....	.....	.....
Trimountain	.....	.....	.....	300,000
Union	50,000	.....	.....	.....
Washington	.....	8,000	.....	.....
Totals	$330,000	$838,000	$480,000	$1,520,000

Company.	1901.	1902.	1903.	1904.
Adventure	$700,000	$200,000	$200,000	$ 50,000
Allouez	300,000	.....	.....	300,000
Baltic	300,000	.....	.....	.....
Centennial	180,000	.....	.....	360,000
Mass	500,000	100,000	100,000	100,000
Michigan	100,000	200,000	300,000	.....
Mohawk	300,000	300,000	200,000	.....
Old Colony	.....	.....	100,000	.....
Phœnix	.....	100,000	100,000	100,000
Rhode Island	.....	100,000	.....	.....
Tecumseh	55,000	.....	.....	.....
Trimountain	200,000	300,000	.....	.....
Victoria	.....	200,000	100,000	.....
Winona	.....	100,000	100,000	.....
Wyandot	.....	.....	.....	100,000
Totals	$2,635,000	$1,600,000	$1,200,000	$1,010,000

Company.	1905.	1906.	1907.
Adventure	.....	$ 50,000	$150,000
Ashbed	$ 40,000	.....	.....
Centennial	360,000	.....	.....
Mass	100,000	.....	.....
Phœnix	.....	.....	150,000
Rhode Island	.....	.....	100,000
Victoria	100,000	.....	.....
Winona	100,000	300,000	200,000
Wyandot	.....	.....	50,000
Totals	$700,000	$350,000	$650,000

CAPITALIZATION OF MICHIGAN COPPER COMPANIES.

Name of Company	Organized under laws	Authorized Capitalization	No. Shares Authorized	No. Shares Issued	No. Shares Unissued
Adventure	Michigan	$2,500,000	100,000	100,000	.....
Ahmeek	Michigan	1,250,000	50,000	50,000	.....
Allouez	Michigan	2,500,000	100,000	100,000	.....
Arcadian	New Jersey	3,750,000	150,000	150,000	.....
Arnold	Michigan	2,500,000	100,000	62,000	38,000
Ashbed	Michigan	1,000,000	40,000	40,000	.....
Atlantic	Michigan	2,500,000	100,000	100,000	.....
Baltic	Michigan	2,500,000	100,000	100,000	.....
Calumet & Hecla	Michigan	2,500,000	100,000	100,000	.....
Centennial	Michigan	2,500,000	100,000	90,000	10,000
Champion	Michigan	2,500,000	100,000	100,000	.....
Copper Range	Michigan	2,500,000	100,000	100,000	.....
Copper Range Cons.	New Jersey	38,500,000	385,000	384,209	791
Elm River	New Jersey	1,200,000	100,000	100,000	.....
Franklin	Michigan	2,500,000	100,000	100 000	.....
Humboldt	Michigan	1,000,000	40,000	40,000	.....
Isle Royale	New Jersey	3,750,000	150,000	150,000	.....
King Philip	Michigan	2,500,000	100,000	100,000	.....
Mass	Michigan	2,500,000	100,000	100,000	.....
Mayflower	Michigan	2,500,000	100,000	100,000	.....
Michigan	Michigan	2,500,000	100,000	100,000	.....
Mohawk	Michigan	2,500,000	100,000	100,000	.....
National	Michigan	2,500,000	100,000	75,000	25,000
Old Colony	Michigan	2,500,000	100,000	100,000	.....
Oneco	Michigan	2,500,000	100,000	100,000	.....
Osceola	Michigan	2,500,000	100,000	96,150	3,850
Phœnix	Michigan	2,500,000	100,000	100,000	.....
*Quincy	Michigan	2,500,000	100,000	100,000	.....
Rhode Island	Michigan	2,500,000	100,000	100,000	.....
St. Mary's M. L. Co.	New Jersey	5,000,000	200,000	150,000	50,000
Seneca	Michigan	1,000,000	40,000	40,000	.....
Superior	Michigan	2,500,000	100,000	60,000	40,000
Tamarack	Michigan	1,500,000	60,000	60,000	.....
Tecumseh	Michigan	2,500,000	100,000	54,959	45,041
Trimountain	Michigan	2,500,000	100,000	100,000	.....
Union C. L. & M. Co.	Michigan	2,500,000	100,000	80,000	20,000
Victoria	Michigan	2,500,000	100,000	100,000	.....
Winona	Michigan	2,500,000	100,000	100,000	.....
Wolverine	Michigan	1,500,000	60,000	60,000	.....
Wyandot	Michigan	2,500,000	100,000	100,000	.....
Totals		$131,950,000	4,175,000	3,942,318	232,682

*Quincy capitalization authorized August, 1906, to be increased to $3,750,000, in 150,000 shares, per $25.

NUMBER OF SHAREHOLDERS IN LAKE COPPER COMPANIES.

1896–1906.

Company	1896	1898	1900	1902	1903	1904	1905	1906
Adventure	.....	....	1,046	1,050	1,089	1,283	1,124	1,093
Ahmeek	.....	....	....	....	....	114	173	195
Allouez	.....	....	465	554	627	726	537	537
Arcadian	.....	....	....	....	....	....	....	1,047
Atlantic	364	401	374	417	457	633	460	488
Baltic	.....	....	513	177	17	10	10	12
Calu. & Hecla	2,464	2,716	3,080	3,425	3,310	3,258	3,493	3,651
Centennial	.....	438	439	597	630	636	534	516
Central	.....	....	203	189	168	224	162	....
Champion	.....	....	....	8	8	8	8	8
Copper Crown	.....	....	....	....	....	....	433	621
Eagle River	.....	....	....	....	....	....	26	....
Elm River	.....	....	....	....	506	562	585	163
Franklin	458	442	945	1,311	1,438	1,429	1,155	880
Frontenac	.....	....	....	....	....	....	6	6
Hancock	.....	....	....	....	....	....	....	570
Hulbert	.....	....	....	....	....	....	19	19
Keweenaw	.....	....	....	....	....	....	....	1,239
King Philip	.....	....	....	....	....	....	7	11
Lake	.....	....	....	....	....	....	....	173
Laurium	.....	....	....	....	....	....	38	40
Manitou	.....	....	....	....	....	....	6	7
Mass	.....	....	477	....	....	....	1,051	1,005
Mayflower	.....	....	399	587	587	594	624	638
Michigan	.....	....	592	933	980	937	870	872
Middle Range	.....	....	....	....	....	....	4	4
Mohawk	.....	....	594	951	1,001	1,076	1,115	434
Old Colony	.....	....	598	721	746	747	763	770
Oneco	.....	....	....	....	....	....	203	192
Osceola	823	1,477	1,512	1,985	1,988	2,089	1,561	1,544
Pacific	.....	....	....	....	....	....	121	122
Phœnix	.....	....	352	582	612	642	671	....
Quincy	978	1,445	1,540	1,557	1,612	1,657	1,541	1,561
Rhode Island	.....	....	1,100	1,216	1,316	1,339	1,013	980
St. Louis	.....	....	....	....	....	....	8	....
Seneca	.....	....	....	....	....	69	91	....
South Range	.....	....	....	....	....	....	26	30
Superior	.....	....	....	....	....	....	100	216
Tamarack	1,178	1,353	1,169	1,286	1,239	1,136	1,019	909
Tecumseh	.....	....	....	....	....	....	....	379
Torch Lake	.....	....	....	....	....	....	23	23
Trimountain	.....	....	780	730	335	41	23	23
Union	.....	....	....	....	....	....	323	327
Victoria	.....	....	796	1,206	1,275	1,324	1,276	1,245
Wheatkate	.....	....	....	....	....	....	5	5
Winona	.....	....	637	909	854	878	758	801
Wolverine	333	625	892	1,223	1,262	1,292	1,266	1,342
Wyandot	.....	....	....	....	....	....	750	657
Totals	6,598	8,897	18,503	21,735	22,068	22,714	23,981	25,195

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The foregoing table shows very plainly the effect of electrical demand for the metal, which first became a factor of importance in the ninth decade, shortly after 1880. Previous to that decade the theoretical increase of 4% annually, compounded, exceeds the actual increase in every decade, but after 1880 the actual increase exceeds the theoretical ratio. The actual copper output of 1900 was 486,732 tons, and the theoretical output for that year, based on the average of the decade 1890-1900, with 21½% increase for 5 years from the mean of 1895, would have been 410,560 tons. It is evident that the average ratio of increase of slightly more than 4% yearly, which ruled during the Nineteenth Century, is not the factor of the present electrical age. What that factor may be is uncertain. The electrification of the globe, while wonderful progress has been made, is not yet a sufficiently established fact to give accurate data for an average ratio of increase in consumption.

The ratio of increase in copper production of the world has been 6% to 8% for several years past. It has grown to be considered an axiom in the copper trade that the normal increase is 8% yearly, but this ratio, while it may be considered the present factor, has not been established for a sufficiently long time to be assured for an indefinite time in the future. The following table gives hypothetical outputs for every tenth year during the Twentieth Century, based upon various percentages of increase, all figured from the actual production of the closing year of the Nineteenth Century. The compound increases, for facility in computation, are taken at slight changes from their actual value, as, for instance, 4% compounded for ten years is figured as 50% increase, instead of 48.02%, the actual figure; 5% is figured at 60%, instead of 62.89%; 7% compounded is figured as 80% in ten years, instead of 79.02%; 8% is figured as only 110% instead of 115.89.

(*Long Tons.*)

Year.	At 4%.	At 5%.	At 7%.	At 8%.
1900.....	486,732	486,732	486,732	486,732
1910.....	730,098	778,771	876,117	1,022,137
1920.....	1,095,147	1,246,033	1,577,011	2,146,488
1930.....	1,642,720	1,993,654	2,838,621	4,507,625
1940.....	2,464,080	3,189,846	5,126,317	9,466,012
1950.....	3,696,121	5,103,754	9,227,372	19,878,626
1960.....	5,544,181	8,166,007	16,609,269	41,745,115
1970.....	8,316,272	13,065,612	29,896,685	87,664,741
1980.....	12,474,408	20,904,980	53,914,033	184,095,956
1990.....	18,711,613	33,447,968	97,045,260	386,601,507
2000.....	28,067,419	52,516,748	174,681,468	811,863,165

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...pper Information Bureau

THE annual publication of the Copper Handbook necessitates the constant gathering and systematic filing of accurate information regarding the technics and statistics of copper and the copper trade generally, also the securing and filing of data covering the finances, organization, equipment, development, ores, management and prospects of several thousand copper mines and copper mining companies in all parts of the world.

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